April 28, 2021

Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

Attention: Ms. Jessica Spence

Re: **Underground Injection Control (UIC) Report**
**SMA 4 – Former Chemical Plant**
**Bluestone Coke, LLC**
**4200 F.L. Shuttlesworth Drive**
**Birmingham, Jefferson County, Alabama**
**USEPA ID No. ALD 000 828 848**
**UIC Permit No. ALSI9937718**
Terracon Project No. E1187346

Dear Ms. Spence:

On behalf of Bluestone Coke, LLC, Terracon Consultants, Inc. (Terracon) is pleased to submit the *Underground Injection Control (UIC) Report for SMA 4 - Former Chemical Plant* for the above-referenced site. This UIC Report has been prepared in response to the requirements of the UIC Permit No. ALSI9937718 issued January 15, 2019.

If you should have any questions, please do not hesitate to contact us at (205) 942-1289.

Sincerely,

***Terracon Consultants, Inc.***

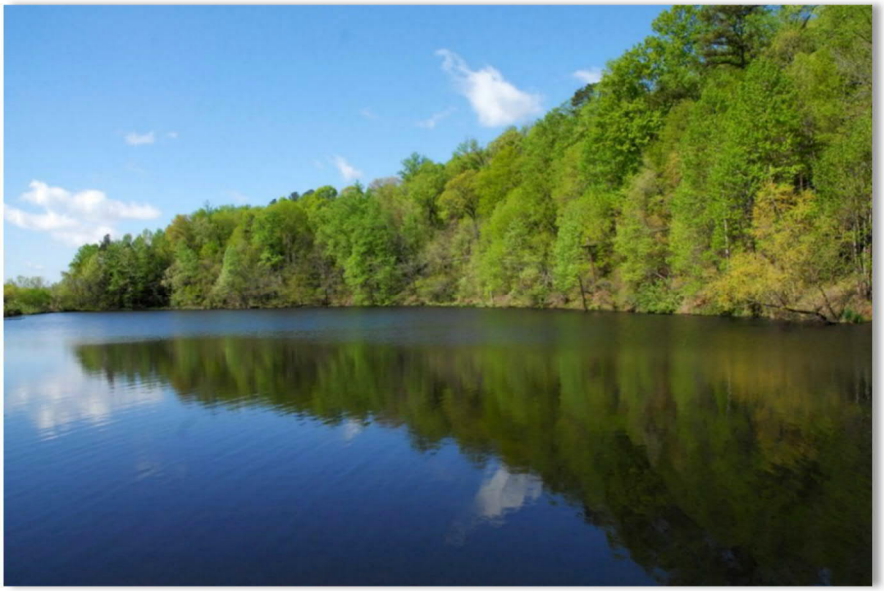
Terrence [illegible], AL-PG #8
Principal Geologist

Andy Smith, AL-PE#28773
Senior Project Engineer

cc: Ms. Meredith Anderson; USEPA Region 4

# Underground Injection Control Report
# SMA 4 – Former Chemical Plant

**Bluestone Coke**
**4200 F.L. Shuttlesworth Drive**
**Birmingham, Alabama**
**US EPA ID No. ALD 000 828 848**
**UIC Permit No. ALSI9937718**
April 28, 2021
Terracon Project No. E1187346



**Prepared for:**
Bluestone Coke
Birmingham, Alabama

**Prepared by:**
Terracon Consultants, Inc.
Birmingham, Alabama

April 28, 2021

Bluestone Compliant Coke
4200 F.L. Shuttlesworth Drive
Birmingham, Alabama 35207

Attention: Mr. Don Wiggins

Re: **Underground Injection Control (UIC) Report**
**SMA 4 – Former Chemical Plant**
**Bluestone Coke, LLC**
**4200 F.L. Shuttlesworth Drive**
**Birmingham, Jefferson County, Alabama**
**USEPA ID No. ALD 000 828 848**
**UIC Permit No. ALSI9937718**
Terracon Project No. E1187346

Dear Mr. Wiggins:

Terracon Consultants, Inc. (Terracon) is pleased to submit this Underground Injection Control (UIC) Report for the site referenced above.

Should you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,
**Terracon Consultants, Inc.**

Terrell W. Rippstein, AL-PG #8
Principal Geologist

Andy Smith, AL-PE#28773
Senior Project Engineer

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## LIST OF ABREVIATIONS

| | |
|---|---|
| ADEM | Alabama Department of Environmental Management |
| AOC | Area of Concern |
| ANPR | Advanced Notice of Proposed Rulemaking |
| CAA | Corrective Action Alternative |
| CAO | Corrective Action Objective |
| CAP | Corrective Action Plan |
| CFR | Code of Federal Regulation |
| cm/sec | centimeter per second |
| CMI | Corrective Measures Implementation |
| CMS | Corrective Measure Study |
| COC | Contaminant of Concern |
| COPC | Constituent of Potential Concern |
| DOT | Department of Transportation |
| EI | Environmental Indicators |
| ERA | Ecological risk assessment |
| FCP | Former Chemical Plant |
| FMC | Five Mile Creek |
| FWI | Facility Wide Investigation |
| HHRA | Human Health Risk Assessment |
| HHRE | Human Health Risk Evaluation |
| HI | Hazard Index |
| IM | Interim Measures |
| IRIS | Integrated Risk Information System |
| LDA | Land Disposal Area |
| LDR | Land Disposal Restriction |
| LUCP | Land Use Control Plan |
| MCL | Maximum Contaminant Level |
| NRWQC | National Recommended Water Quality Criteria |
| Order | Administrative Order on Consent |
| OSHA | Occupational Safety and Health Administration |
| PCS | Preliminary Cleanup Standards |
| PIF | Pig Iron Foundry |
| PPE | Personal Protective Equipment |
| PRG | Preliminary Remediation Goal |
| PVC | Poly Vinyl Chloride |
| RAGS | Risk Assessment Guidance for Superfund |
| RCRA | Resource Conservation and Recovery Act |
| RCRIS | RCRA Information System |
| PCS | Preliminary Cleanup Standards |
| RFI | RCRA Facility Investigation |

| | |
|---|---|
| RSL | Regional Screening Levels |
| SMA | SWMU Management Area |
| SSL | Soil screening level |
| SVOC | Semi-Volatile Organic Compound |
| SWMU | Solid Waste Management Unit |
| TCL | Target Constituent List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TSD | Treatment, Storage, And Disposal |
| UCL | Upper Confidence Limit |
| USEPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Compounds |

# Underground Injection Control (UIC) Report
# SMA 4 – Former Chemical Plant

**Bluestone Coke**
**4200 F.L. Shuttlesworth Drive**
**Birmingham, Alabama**
**US EPA ID No. ALD 000 828 848**
**UIC Permit N0. ALSI9937718**
Project No. E1187346
**April 28, 2021**

## 1.0 INTRODUCTION/PURPOSE

The Bluestone Coke, LLC facility is located at 4200 F.L. Shuttlesworth Drive in Birmingham, Jefferson County, Alabama (Figure 1). This Underground Injection Control (UIC) Report for SMA 4 has been prepared based on the requirements of the UIC Permit No.: ALSI9937718 issued January 25, 2019. A map of the area of SMA 4 is included as Figure 2.

### 1.1 Corrective Measures Study (CMS) Overview

Terracon on behalf of Bluestone Coke, submitted the *Corrective Measures Study (CMS) SMA-4 – Former Chemical Plant (Revision 1.1)* to the US EPA on April 14, 2017. The purpose of the CMS Report was to summarize the evaluation, analysis, and selection of appropriate corrective measures at SMA 4.

Based on the activities conducted during the CMS for SMA, it was determined that:

- COCs exceeded an ELCR of 10-6 and an HI of 0.1 in soil and groundwater.
- For the construction worker scenario and industrial worker scenario, the cumulative risk across all media is greater than an ELCR of 10-4 and an HI of 1.0.
- For the construction worker scenario and industrial worker scenario, the cumulative risk for subsurface soil exceeds an HI of 1.0, and several constituents exceed an HQ of 0.1 for a construction worker setting.
- A comparison of soil COC concentrations for leachability to soil factors indicate certain exceedances of GWP SSLs in subsurface soils.
- The soil contamination is deemed not to warrant corrective action based on the risk to human health being controlled by a LUCP; however, some areas where soil COCs exceed the GWP SSLs are recommended for remediation.
- Active groundwater remediation is also recommended.

Based on these conclusions and a detailed analysis that was performed individually and collectively with respect to the five alternatives, Alternative 5 - Land Use Controls + In-Situ Soil

Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring is recommended as the corrective action alternative for SMA 4.

The *Final (Remedy) Decision for the Former Chemical Plant* from the US EPA dated February 2018 indicated that they concurred with the recommendations from the CMS for SMA 4.

The recommended remedy found in the facility's April 14, 2017, Corrective Measure Study Report and proposed to the public on October 1, 2017, is identified as Alternative 5: Land Use Controls + In-Situ Soil Source Area Treatment + Groundwater Removal and Treatment + Groundwater Monitoring. This alternative can reasonably be concluded to satisfy all of the Facility-Specific Corrective Action Objectives found in Table 3; therefore, it is EPA's Final Decision that Alternative 5, which consists of the following components, be the remedy for the Former Chemical Plant.

- Land Use Controls: Land use controls are administrative means to protect current and future human exposure to unacceptable environmental contamination. This protection will be accomplished through the following techniques/components:
  - Land Use Control Plan (LUCP) developed by the Facility (and overseen by EPA)
  - An Environmental Covenant secured under the Alabama Uniform Environmental Covenants Act, Ala. Code §§ 35-19-1 to 35-19-14 (2007 Cum. Supp.).
- In-Situ Soil Source Area Treatment/In-Situ Groundwater Treatment: Chemicals, bacteria (e.g., zero valent iron, yeast extract, micronutrients, potassium permanganate, etc.), or steam will be used with the purpose of helping prevent any further release of contaminants from the soil to the groundwater and aiding in advancing the groundwater remediation. Bench scale studies will need to be conducted to determine the appropriate chemicals or bacteria to be used, the concentrations, locations, etc.
- Groundwater Removal and Treatment: The hydraulic control well network, which was installed under an Interim Measures in 2013 to control the VOC groundwater plume and currently consists of 6 extraction wells, will continue. The recovered groundwater will be used as process water for the coke plant and will eventually cycle to the Facility's Biological Treatment Facility (BTF) for subsequent discharge in compliance with the Facility's NPDES Permit.
- Groundwater Monitoring: Long-term groundwater monitoring will occur to assess the effectiveness of the overall remediation system.

This alternative 5 was chosen and a Corrective Measures Implementation (CMI) Plan was prepared for SMA 4. The UIC Permit was acquired as part of the recommended in-situ soil source area and groundwater treatment proposed in the CMI Work Plan. A Pilot Test consisting of two injection events was proposed prior to full scale implementation of the CMI.

# 2.0 PILOT TEST

## 2.1 In-Situ Soil Source Area Treatment

The subsurface area in SMA 4 with high concentrations of benzene, toluene, and chlorobenzene was determined to be approximately 240 feet in length and 120 feet in width (Figure 3). It was determined that a Pilot Test would be conducted in a portion of SMA 4 in which in-situ chemical oxidation (ISCO) would be used to treat the soil source and associated groundwater. The Pilot Test will consist of two injection events. This report documents the first injection event which was conducted from November 13 through 22, 2020 and January 26 through 29, 2021. The second injection event will be conducted in summer 2021.

**Chemical Oxidiation**

In-situ chemical oxidation (ISCO) involves the injection or direct mixing of reactive chemical oxidants into the soil source area for the primary purpose of rapid and complete contaminant destruction of the chemicals-of-concern (COCs). ISCO is a versatile treatment technology that is most often deployed in source zones characterized by moderate to high contaminant concentrations in sorbed contaminants, and the potential presence of residual, separate-phase contamination.

ISCO directly oxidizes contaminants while its unique catalytic component generates a range of highly oxidizing free radicals that rapidly and effectively destroy a range of target contaminants including both petroleum hydrocarbons and chlorinated compounds (if present). Chemicals such as RegenOx® and Petrocleanz™ are injectable, two-part ISCO reagents that combines a solid sodium percarbonate based alkaline oxidant (Part A), with a liquid mixture of sodium silicates, silica gel and ferrous sulfate (Part B), resulting in a powerful contaminant destroying technology.

Once emplaced in the subsurface, these chemicals produce a cascade of highly-efficient chemical oxidation reactions via a number of mechanisms including:

- Surface mediated oxidation
- Direct oxidation
- Free radical oxidation

These reactions destroy a range of contaminants and can be propagated for periods of up to 30 days on a single injection.

In addition to chemical destruction, ISCO provides a short-term oxygen footprint that is optimal for establishing aerobic conditions capable of supporting follow-on, aerobic biodegradation of petroleum hydrocarbons. Once aerobic conditions are in place, the ISCO may support long-term aerobic biodegradation. This “ISCO to bio” combined remedies approach can be highly effective

at reducing a range of contaminant concentrations and associated costs. Since it is intended that the injection will also extend into the saturated zone, the water in the hydrocarbon plume will become oxygenated and assist in remediation of the dissolved hydrocarbon plume also.
Prior to performing ISCO injection, a Class V UIC Permit was obtained and two horizontal injection wells were installed.

### 2.1.1 Underground Injection Control Permit

The Class V UIC Permit for ISCO injection at the Bluestone Coke (ERP Compliant Coke, LLC) was issued by ADEM on January 25, 2019 with an expiration date of January 24, 2024.

### 2.1.2 Horizontal Injection Well Installation

Two horizontal injection wells (HIW-1 and HIW-2) were installed in the soil source area (Figure 3). They were installed on the upgradient end of the soil source area and were spaced 50 feet apart. Directional Technologies, Inc. was contracted by Bluestone Coke to install the two horizontal injection/recovery wells. Directional Technologies, Inc. Horizontal Well As-Built Completion and Well Testing Report prepared February 6, 2019 in included as Appendix A.

### 2.1.3 Pilot Test

The Pilot Test is being performed to determine the effectiveness of the ISCO to remediate the soils source area and secondarily remediate groundwater. The pilot test will be used to determine if a full scale ISCO injection will effectively treat the entire soil source area.

#### 2.1.3.1 ISCO Injection

Regenesis Remediation Services (Regenesis) was contracted by Bluestone Coke to inject PetroCleanze and RegenOx into the subsurface to enhance the remediation of the COCs. Material Safety Data Sheets for these chemicals were submitted as Appendix A of the UIC Permit application dated September 7, 2018. The first of two scheduled injection events occurred on November 13 through 22, 2020 and January 26 through 29, 2021. The second event will be conducted in summer 2021. A summary of the Regenesis injection event is included as Appendix B.

## 2.2 Permit Required Groundwater Monitoring

UIC Permit No. ALSI9937718 requires groundwater monitoring wells MW-70, MW-71, MW-72 and MW-89 be sampled prior to the initial injection and then quarterly for pH, iron, and sulfate.

Groundwater sampling has been conducted quarterly since August 2019. The analytical results for sulfate, iron, and pH are included on Table 1. Five quarterly events were conducted prior to the initial injection which started in November 2020. Two quarterly events have been conducted since that event. Base on a review of the analytical data, there does not appear to be any difference in sulfate, iron, or pH concentrations since injection was started.

The next quarterly sampling report will be submitted in July 2021.

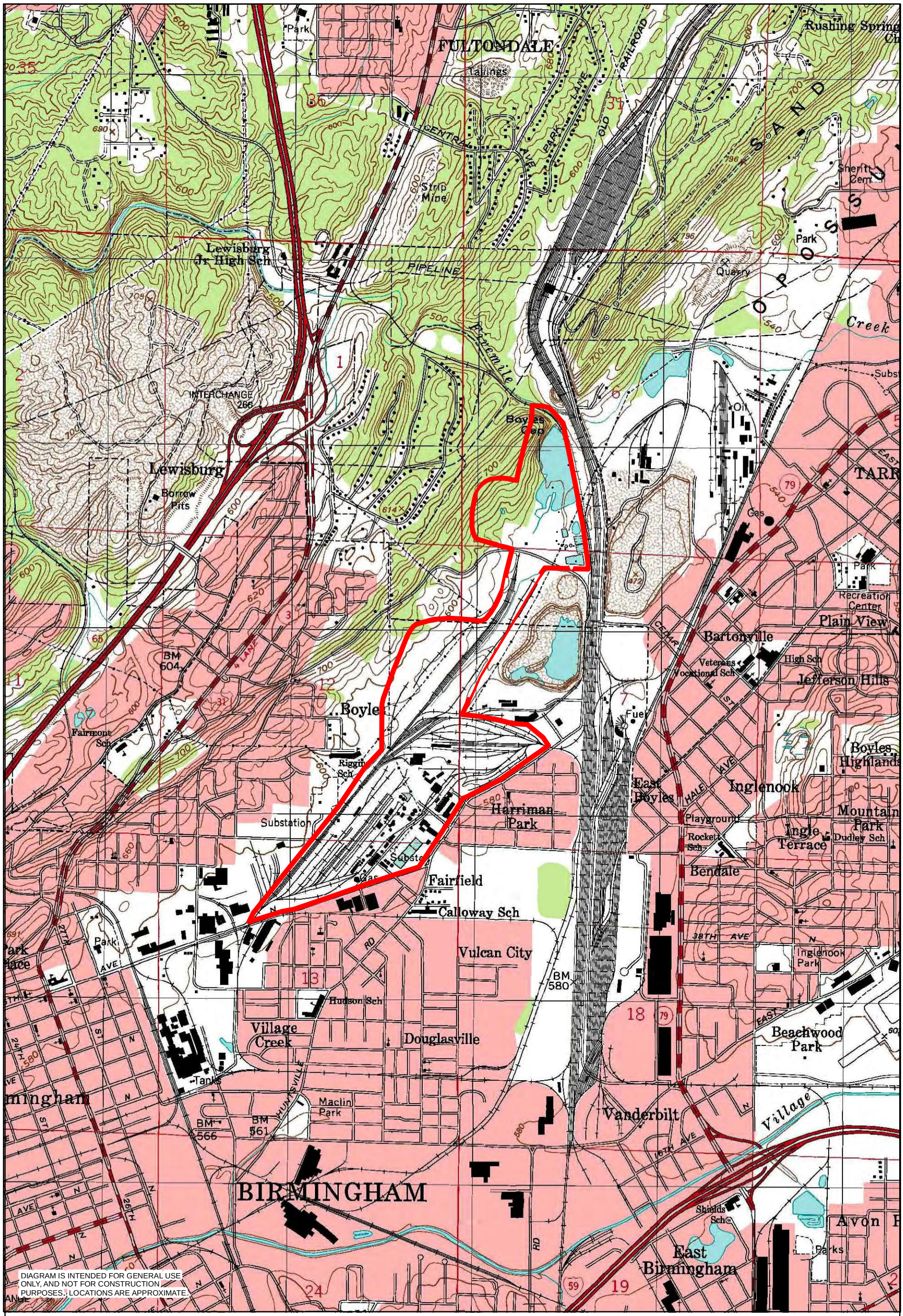
# TABLES

Table 1. Summary of Sulfate, Iron, and pH Analytical Results
Bluestone Coke - Birmingham, AL

| Well Number | Date | Sulfate | Iron | pH |
|---|---|---|---|---|
| | | mg/L | mg/L | SU |
| MW-70 | 8/15/2019 | 76 | 0.98 | 6.86 |
| | 11/25/2019 | 57 | 0.33 | 7.02 |
| | 2/27/2020 | 44 | 0.46 | 7.05 |
| | 5/28/2020 | 47 | 0.8 | 6.86 |
| | 10/6/2020 | 62 | 0.91 | 7.02 |
| | 1/6/2021 | 62 | 0.86 | 7.06 |
| | 3/10/2021 | 55 | 0.79 | 7.10 |
| MW-71 | 8/15/2019 | 97 | 31 | 6.82 |
| | 11/25/2019 | 64 | 65 | 7.07 |
| | 2/28/2020 | 66 | 26 | 6.97 |
| | 5/28/2020 | 64 | 9.7 | 7.05 |
| | 10/6/2020 | 71 | 17 | 7.38 |
| | 1/6/2021 | 83 | 4.2 | 7.11 |
| | 3/10/2021 | 74 | 6.2 | 7.04 |
| MW-72 | 8/15/2019 | 57 | 1 | 6.9 |
| | 11/25/2019 | 250 | 0.74 | 7.11 |
| | 2/27/2020 | 260 | 0.99 | 7.02 |
| | 5/28/2020 | 49 | 0.54 | 7.08 |
| | 10/6/2020 | 270 | 0.70 | 7.07 |
| | 1/6/2021 | 310 | 0.55 | 7.14 |
| | 3/10/2021 | 260 | 0.38 | 7.12 |
| MW-89 | 8/15/2019 | <5.0 | 48 | * |
| | 11/25/2019 | <5.0 | 200 | * |
| | 2/27/2020 | <5.0 | 160 | * |
| | 5/28/2020 | <5.0 | 13 | * |
| | 10/6/2020 | <5.0 | 26 | * |
| | 1/6/2021 | <5.0 | 110 | * |
| | 3/10/2021 | <5.0 | 59 | * |

mg/L = millgrams per liter
SU = Standard Units
* Not enough water to collect pH reading. Well must be sampled with passive diffuser bag because of lack of water to purge.

# FIGURES




## Legend

Facility Boundary

TOPOGRAPHIC
North Birmingham, AL
7.5 Minute Quadrangle, USGS, 1997

0 2,500 Feet

| | |
|---|---|
| Date: | |
| PM: | TWR |
| Project: | E1187346 |
| Author | |

Terracon
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

FACILITY LOCATION MAP

**Bluestone Coke**
4200 F.L. Shuttlesworth Drive
Birmingham, AL

FIGURE

**1**

SWMU #35 - Mineral Wool Waste Piles

SWMU #42 - Former Aboveground Storage Tanks (ASTs)

SWMU #36 - Used Oil Tank

MW-80

MW-81

SWMU #27 - Floor Drain System

SWMU #29 - Product Tank Containment Area

MW-55

MW-56

SWMU #28 - Salfonation Floor Drain

MW-78

MW-54

SWMU #30 - Centrifuge Waste Water Tank

MW-53

MW-52

MW-77

MW-49D

SWMU #26 - Main Process Building

MW-72

MW-51

MW-50

SWMU #33 - Plant Drum Storage Area

MW-70

MW-90

MW-89

SWMU #34 - Wastewater Neutralization System

MW-71

SWMU #31 - Monohydrate Floor Drain and Sump

SWMU #32 - Drum Storage Area

DIAGRAM IS INTENDED FOR GENERAL USE ONLY, AND NOT FOR CONSTRUCTION PURPOSES. LOCATIONS ARE APPROXIMATE.

**Legend**

- Shallow Bedrock Monitoring Well
- Deep Bedrock Monitoring Well
- Residium or Mixed Monitoring Well
- Non-Conasauga Limestone Monitoring Well
- Base

Note:
1) SWMU - Solid Waste Management Unit
2) Management Area boundaries are approximations
3) AOC - Area of Concern

0 120 240 480 Feet

N

Date:
PM: TWR
Project: E1187346
Author:

Terracon
110 12th St. North Birmingham, Alabama 35203
Phone: (205) 942-1289 Fax: (205) 443-5302

FORMER CHEMICAL PLANT MAP

**Bluestone Coke**
4200 F.L. Shuttlesworth Drive
Birmingham, AL

FIGURE
**2**


NOTES:

DATA SOURCES:
- Well locations: CH2M Hill
- Basemap imagery: ESRI

N

| | |
|---|---|
| Project No | E1187346 |
| Drawn By: | IMS |
| Reviewed By: | TWR |
| Date: | June 2018 |


Terracon
Consulting Engineers & Scientists
110 12th Street North Birmingham, Al 35203
PH. (205) 942 1289 terracon.com


**Soil-Source Area Map**

**Bluestone Coke**
4200 F.L. Shuttlesworth Drive
Birmingham, AL

Figure
3

M:\GIS\E1127096_Walter_Coke_ALT_project\mxd\2018_06_AnnualReport_2017_08_Thru_2018_05\Working\E1177308_ERPCoke_BlankSiteLayout.mxd

# APPENDIX A
# Directional Technologies Horizontal Well Completion Report

DIRECTIONAL
Technologies, Inc
Horizontal Remediation Wells

February 6, 2019

Mr. Terrell W. Rippstein, P.G.
Terracon Consultants, Inc.
2147 Riverchase Office Road
Birmingham, Alabama 35244

**RE: Horizontal Well As-Built Completion and Injection Testing Report**
**ERP Coke, Inc.**
**3500 35th Avenue North**
**Birmingham, Alabama**

Dear Mr. Rippstein:

Directional Technologies greatly appreciates the opportunity to provide Terracon with horizontal remediation wells at the ERP Coke facility in Birmingham, Alabama. This report documents horizontal well completion data, horizontal injection well testing, and daily activities for the project. Field work for the horizontal well installation took place from December 17, 2018 through January 12 2019. Directional Technologies completed the installation of the two (2) horizontal injection wells (HIW-1 and HIW-2).

Enclosed in this report you will find the following attachments:

- Attachment A, As-Built Horizontal Well Diagrams;
- Attachment B, Tables 1 & 2: As-Built Horizontal Well Navigation Data;
- Attachment C, Tables 3 & 4: Horizontal Well Water Injection Test Data;
- Attachment D, Daily Drilling Reports

Please do not hesitate to contact me at 877-788-4479 or my cell phone 850-585-4415 if you have any questions.

Sincerely,
Directional Technologies, Inc.

Kyle Carlton, P.G.
Senior Geologist and Business Development Manager

130 S. Geronimo Street, Unit 2 · Miramar Beach, FL 32550· Tel 203-294-9200 · Fax 203-294-9201
www.directionaltech.com

# ATTACHMENT A

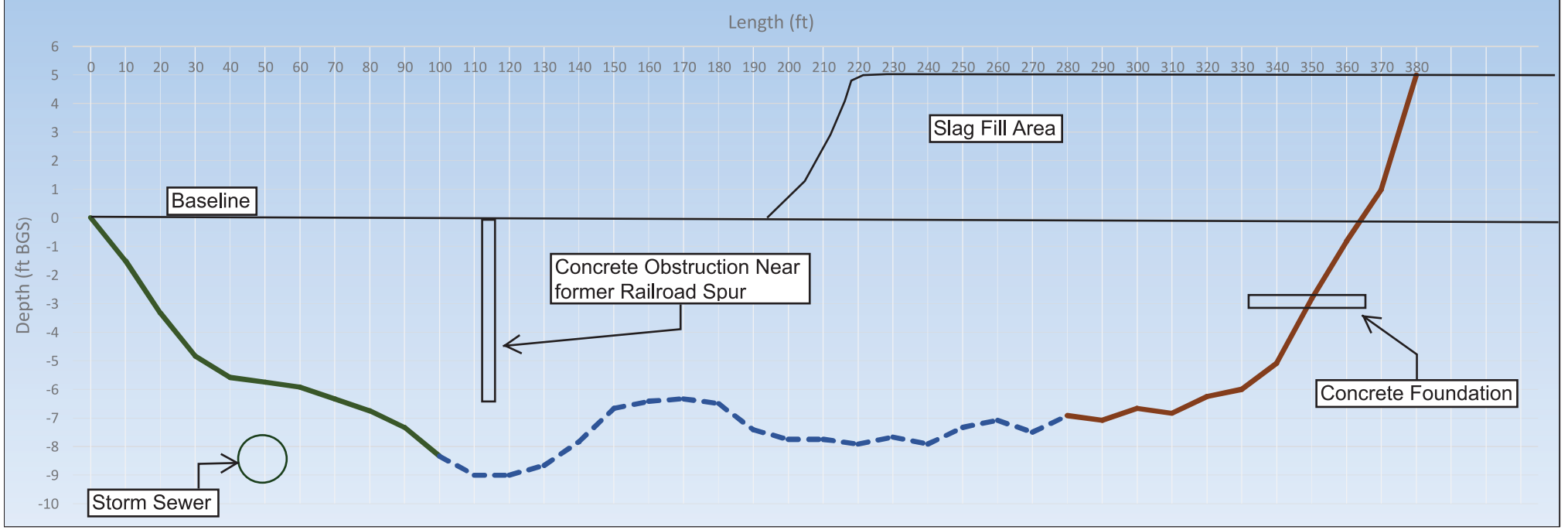
# AS-BUILT HORIZONTAL WELL DIAGRAMS

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# As-Built Horizontal Well Diagram

## Well: HIW-1

**Terracon - ERP Coke - Birmingham, Alabama**




**Legend:**

**Entry Casing:**

**Screen Section:**

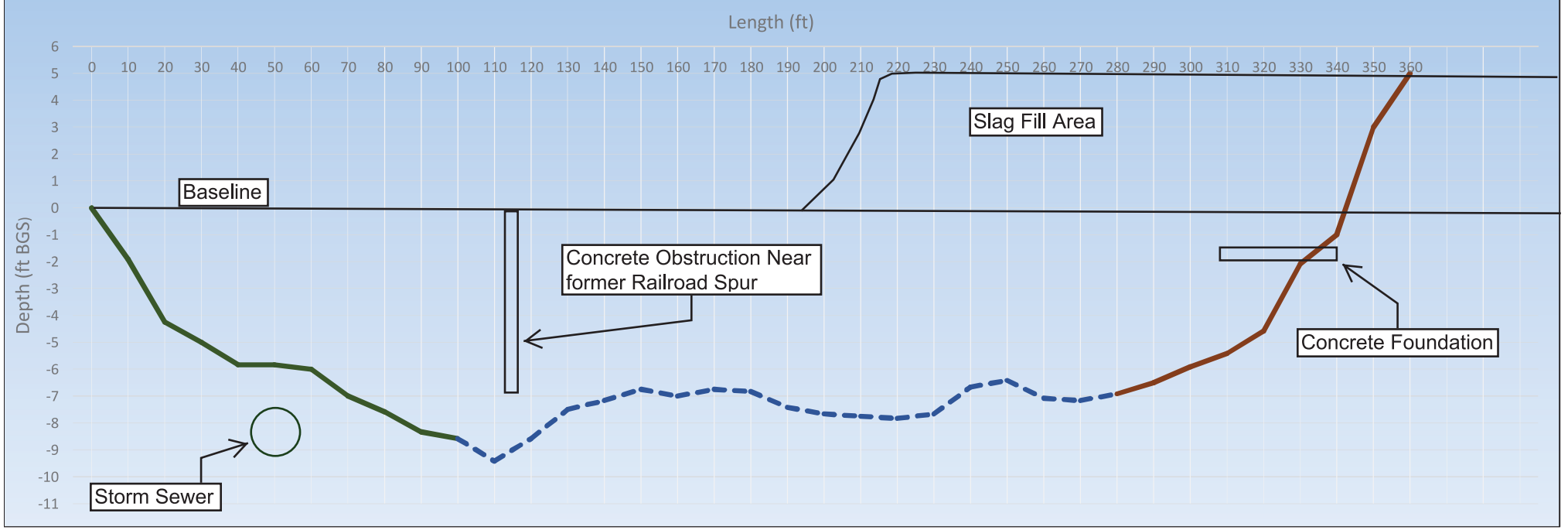
**Exit Casing:**

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# As-Built Horizontal Well Diagram

## Well: HIW-2

**Terracon - ERP Coke - Birmingham, Alabama**




**Legend:**

**Entry Casing:**

**Screen Section:**

**Exit Casing:**

# ATTACHMENT B

# TABLES 1 & 2 – AS-BUILT HORIZONTAL WELL NAVIGATION DATA

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Table 1
## As-Built Horizontal Well Navigation Data
## Well: HIW-1
## Terracon - ERP Coke - Birmingham, Alabama

| | | | |
|---|---|---|---|
| **Driller:** | Justin Acri | **Length of Borehole (Horizontal):** | 380 feet |
| **Rig:** | DW 2720 | **Entry Casing Lenth:** | 100 feet |
| **Rod Length:** | 10 ft | **Screen Length:** | 180 feet |
| **Well Material:** | 4-inch HDPE | **Exit Casing Length:** | 100 feet |

| Rod # | | Horizontal Distance From Rig (ft) | Depth Relative to Baseline (ft) | Pitch (percent) | Ground Conditions/ Driller's Comments |
|---|---|---|---|---|---|
| Entry Casing (0 ft to 100 ft) | 0 | 0 | 0 | -22.0 | |
| | 1 | 10 | -1.50 | -13.0 | Obstructions / Fill Material |
| | 2 | 20 | -3.33 | -3.0 | |
| | 3 | 30 | -4.83 | +0.5 | |
| | 4 | 40 | -5.58 | +14 | |
| | 5 | 50 | -5.75 | +5.4 | |
| | 6 | 60 | -5.92 | -4.4 | |
| | 7 | 70 | -6.33 | -8.6 | |
| | 8 | 80 | -6.75 | -8.0 | |
| | 9 | 90 | -7.33 | -8.0 | |
| | 10 | 100 | -8.33 | -7.8 | Start of Screen |
| Screen Section (100 ft to 280 ft) | 11 | 110 | -9.00 | -0.3 | Under Concrete Foundation |
| | 12 | 120 | -9.00 | +7.8 | |
| | 13 | 130 | -8.67 | +11.5 | |
| | 14 | 140 | -7.83 | +13.5 | |
| | 15 | 150 | -6.67 | +11.0 | |
| | 16 | 160 | -6.42 | +2.0 | |
| | 17 | 170 | -6.33 | -5.0 | |
| | 18 | 180 | -6.50 | -6.6 | |
| | 19 | 190 | -7.42 | -4.0 | |
| | 20 | 200 | -7.75 | -8.0 | |
| | 21 | 210 | -7.75 | +2.2 | Base of Fill Area |
| | 22 | 220 | -7.92 | +3.2 | |
| | 23 | 230 | -7.67 | +8.4 | |
| | 24 | 240 | -7.92 | +9.5 | |
| | 25 | 250 | -7.33 | +9.5 | |
| | 26 | 260 | -7.08 | -0.2 | |
| | 27 | 270 | -7.50 | +0.3 | |
| | 28 | 280 | -6.92 | +0.8 | End of Screen |
| Exit Casing (280 ft to 380 ft) | 29 | 290 | -7.08 | +6.6 | |
| | 30 | 300 | -6.67 | +17.0 | |
| | 31 | 310 | -6.83 | +2.4 | |
| | 32 | 320 | -6.25 | -6.4 | |
| | 33 | 330 | -6.00 | 4.4 | |
| | 34 | 340 | -5.08 | +2.6 | |
| | 35 | 350 | -2.83 | +1.0 | Refusal - Under Foundation |
| | 36 | 360 | -0.83 | +10 | Excavation for Bit Exit |
| | 37 | 370 | 1.00 | +15 | Excavation for Bit Exit |
| | 38 | 380 | 5.00 | +20 | Excavation for Bit Exit |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Table 2
## As-Built Horizontal Well Navigation Data
## Well: HIW-2
## Terracon - ERP Coke - Birmingham, Alabama

| | | | |
|---|---|---|---|
| **Driller:** | Justin Acri | **Length of Borehole (Horizontal):** | 360 feet |
| **Rig:** | DW 2720 | **Entry Casing Lenth:** | 100 feet |
| **Rod Length:** | 10 ft | **Screen Length:** | 180 feet |
| **Well Material:** | 4-inch HDPE | **Exit Casing Length:** | 80 feet |

| Rod # | | Horizontal Distance From Rig (ft) | Depth Relative to Baseline (ft) | Pitch (percent) | Ground Conditions/ Driller's Comments |
|---|---|---|---|---|---|
| Entry Casing (0 ft to 100 ft) | 0 | 0 | 0 | -22.0 | |
| | 1 | 10 | -1.92 | -13.0 | |
| | 2 | 20 | -4.25 | -3.0 | |
| | 3 | 30 | -5.00 | +0.5 | |
| | 4 | 40 | -5.83 | +14 | |
| | 5 | 50 | -5.83 | +5.4 | |
| | 6 | 60 | -6.00 | -4.4 | |
| | 7 | 70 | -7.00 | -8.6 | |
| | 8 | 80 | -7.58 | -8.0 | |
| | 9 | 90 | -8.33 | -8.0 | |
| | 10 | 100 | -8.58 | -7.8 | Start of Screen |
| Screen Section (100 ft to 280 ft) | 11 | 110 | -9.42 | -0.3 | Under Concrete Foundation |
| | 12 | 120 | -8.58 | +7.8 | |
| | 13 | 130 | -7.50 | +11.5 | |
| | 14 | 140 | -7.17 | +13.5 | |
| | 15 | 150 | -6.75 | +11.0 | |
| | 16 | 160 | -7.00 | +2.0 | |
| | 17 | 170 | -6.75 | -5.0 | |
| | 18 | 180 | -6.83 | -6.6 | |
| | 19 | 190 | -7.42 | -4.0 | |
| | 20 | 200 | -7.67 | -8.0 | |
| | 21 | 210 | -7.75 | +2.2 | Base of Fill Area |
| | 22 | 220 | -7.83 | +3.2 | |
| | 23 | 230 | -7.67 | +8.4 | |
| | 24 | 240 | -6.67 | +9.5 | |
| | 25 | 250 | -6.42 | +9.5 | |
| | 26 | 260 | -7.08 | -0.2 | |
| | 27 | 270 | -7.17 | +0.3 | |
| | 28 | 280 | -6.92 | +0.8 | End of Screen |
| Exit Casing (280 ft to 360 ft) | 29 | 290 | -6.50 | +6.6 | |
| | 30 | 300 | -5.92 | +17.0 | |
| | 31 | 310 | -5.42 | +2.4 | |
| | 32 | 320 | -4.58 | -6.4 | |
| | 33 | 330 | -2.08 | 4.4 | Refusal - Under Foundation |
| | 34 | 340 | -1.00 | +2.6 | Excavation for Bit Exit |
| | 35 | 350 | 3.00 | +1.0 | Excavation for Bit Exit |
| | 36 | 360 | 5.00 | +10 | Excavation for Bit Exit |

# ATTACHMENT C

# TABLES 3 & 4:  HORIZONTAL WELL WATER INJECTION TEST DATA

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Table 3
## Horizontal Well Water Injection Test Data
## Well: HIW-1
## Terracon - ERP Coke - Birmingham, Alabama

**Test Date: January 12, 2019**

| | | | |
|---|---|---|---|
| **Well Material:** | 4-inch HDPE | **Screen Length:** | 180 feet |
| **Slot Width:** | 0.020 inches | **Percent Open Area Per foot:** | 33% |
| **Total Well Length:** | 380 feet | **One Well Volume:** | 248 gallons |

| Time (Actual) | Test Duration (Minutes) | Flow Meter Reading | Gallons Pumped | Flow rate (GPM) | Pressure (PSI) | Comments |
|---|---|---|---|---|---|---|
| 9:10 (begin) | 0 | 5058 | 0 | 0.0 | 0.0 | |
| 9:12 | 2 | 5093 | 35 | 17.5 | 2.0 | |
| 9:14 | 4 | 5128 | 35 | 17.5 | 2.0 | Daylighting observed near former railroad spur |
| 9:16 | 6 | 5159 | 31 | 15.5 | 2.0 | |
| 9:18 | 8 | 5184 | 25 | 12.5 | 2.0 | |
| 9:20 | 10 | 5211 | 27 | 13.5 | 2.0 | |
| 9:22 | 12 | 5238 | 27 | 13.5 | 2.0 | |
| 9:24 | 14 | 5264 | 26 | 13.0 | 2.0 | |
| 9:26 | 16 | 5296 | 32 | 16.0 | 2.0 | |
| 9:28 | 18 | 5318 | 22 | 11.0 | 2.0 | |
| 9:30 | 20 | 5347 | 29 | 14.5 | 2.0 | |
| 9:32 | 22 | 5371 | 24 | 12.0 | 2.0 | |
| 9:34 | 24 | 5396 | 25 | 12.5 | 2.0 | |
| 9:36 | 26 | 5422 | 26 | 13.0 | 2.0 | |
| 9:38 | 28 | 5449 | 27 | 13.5 | 2.0 | |
| 9:40 | 30 | 5473 | 24 | 12.0 | 2.0 | |
| 9:42 | 32 | 5498 | 25 | 12.5 | 2.0 | |
| 9:44 | 34 | 5524 | 26 | 13.0 | 2.0 | |
| 9:46 | 36 | 5550 | 26 | 13.0 | 2.0 | |
| 9:47 | 37 | 5562 | 12 | 12.0 | 2.0 | |
| -- | -- | -- | Total Gallons | Average GPM | Average PSI | |
| | | Final Totals / Averages: | **504** | **13.6** | **2.0** | |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Table 4
## Horizontal Well Water Injection Test Data
## Well: HIW-2
## Terracon - ERP Coke - Birmingham, Alabama

**Test Date: January 12, 2019**

| | | | |
|---|---|---|---|
| **Well Material:** | 4-inch HDPE | **Screen Length:** | 180 feet |
| **Slot Width:** | 0.020 inches | **Percent Open Area Per foot:** | 33% |
| **Total Well Length:** | 360 feet | **One Well Volume:** | 235 gallons |

| Time (Actual) | Test Duration (Minutes) | Flow Meter Reading | Gallons Pumped | Flow rate (GPM) | Pressure (PSI) | Comments |
|---|---|---|---|---|---|---|
| 7:56 (begin) | 0 | 4552 | 0 | 0.0 | 0.0 | |
| 7:58 | 2 | 4583 | 31 | 15.5 | 5.0 | |
| 8:00 | 4 | 4607 | 24 | 12.0 | 6.0 | |
| 8:02 | 6 | 4631 | 24 | 12.0 | 6.0 | |
| 8:04 | 8 | 4658 | 27 | 13.5 | 6.0 | |
| 8:06 | 10 | 4680 | 22 | 11.0 | 6.0 | |
| 8:08 | 12 | 4704 | 24 | 12.0 | 6.0 | |
| 8:10 | 14 | 4730 | 26 | 13.0 | 6.0 | |
| 8:12 | 16 | 4753 | 23 | 11.5 | 6.0 | |
| 8:14 | 18 | 4778 | 25 | 12.5 | 6.0 | |
| 8:16 | 20 | 4800 | 22 | 11.0 | 6.0 | |
| 8:18 | 22 | 4825 | 25 | 12.5 | 6.0 | |
| 8:20 | 24 | 4846 | 21 | 10.5 | 6.0 | |
| 8:22 | 26 | 4872 | 26 | 13.0 | 6.0 | |
| 8:24 | 28 | 4894 | 22 | 11.0 | 6.0 | |
| 8:26 | 30 | 4919 | 25 | 12.5 | 6.0 | |
| 8:28 | 32 | 4941 | 22 | 11.0 | 6.0 | |
| 8:30 | 34 | 4965 | 24 | 12.0 | 6.0 | |
| 8:32 | 36 | 4989 | 24 | 12.0 | 6.0 | |
| 8:34 | 38 | 5013 | 24 | 12.0 | 6.0 | |
| 8:36 | 40 | 5037 | 24 | 12.0 | 6.0 | |
| 8:38 | 42 | 5058 | 21 | 10.5 | 6.0 | |
| -- | -- | -- | **Total Gallons** | **Average GPM** | **Average PSI** | |
| | | **Final Totals / Averages:** | **506** | **12.0** | **6.0** | |

# ATTACHMENT D

# DAILY DRILLING REPORTS

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #1

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Mild, High 55 |

| | |
|---|---|
| **Date:** | 12/17/2018 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 12/17/2018 | 11:15 | 17:00 | 5.75 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 5.75 |

:

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 700 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| HIW-1 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Total** | | | **0** | **580** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| No drilling performed today. Setup and Utility Clearance | Day 1. Directional Technologies arrived onsite at 11:15. Checked in at security and received health and safety training from Don Wiggins. Proceeded with unloading equipment. Kyle and Justin plotted bore paths, entry locations, exit locations, start and end of screen. Approximately 13:15 the private line locator GPRS arrived on site to search for unknown utilities. Verified the location of the water line along the northwestern boundary of the work area. Attempting to locate a storm sewer approximately 8 feet bgs near the end of screen locations. Confirm target depths with Terracon, 5' to 7' at bottom of the fill area. Begin excavating entry pit. Ground conditions are very hard. Will begin drilling for HIW-1 tomorrow morning. Directional Technologies crew offsite by 17:00. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #2

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Sunny, High low 60s |

| | |
|---|---|
| **Date:** | 12/18/2018 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 12/17/2018 | 11:15 | 17:00 | 5.75 |
| 12/18/2018 | 7:00 | 17:00 | 10.00 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 15.75 |

| **DTI Personnel on Site:** |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| **Mud Mixing** | # |
|---|---|
| Bentonite (50 lbs. units) | 3 |
| PAC (1 lb units) | 0 |
| | |

| **Water Usage** | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| JD 310 Backhoe | 1/2 day rental for excavation of entry pits and test pit. |
| | |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 25 | 290 | 9% | 0% | 0% | 0% | 0% | 0% | 1% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Total** | | | **25** | **580** | **4%** | **0%** | **0%** | **0%** | **0%** | **0%** | **1%** |

| **Ground Conditions and Fluid Notes:** | **Brief Daily Activities Summary:** |
|---|---|
| Tough ground conditions, obstruction at 5.5 feet BGS (foundation slab) | Day 2. Directional Technologies arrived onsite at 7:00. Prepare to begin drilling for HIW-1. Excavate entry pit by hand (tough, hard packed ground/fill material) and begin drilling with small diameter bog bit. Bog bit would not advance, refusal. Switch to spade bit. Use the drill rig's vertical anchor augers to breakup ground in front of the entry pit to help bit advance through hardpack fill. The spade bit was able to advance to 25 feet total length and 5.5 feet deep when encountered very hard obstruction causing drastic pitch change, pushing bit upward. Offset bore approximately 10 feet to the north for a second attempt. Ground is too hard to dig entry pit by hand. 11:00, break to get a backhoe for entry pit. Back onsite by 12:00 and to excavate second entry pit. Begin second attempt for HIW-1. Same results, advanced to approximately 25 feet total length at 5.5 feet in depth and encounter same obstruction. Suspect a foundation. Use the backhoe to dig a test pit, at the location of refusal. Expose a flat concrete foundation slab at 5.5 feet bgs. At 15:00 onsite meeting with Don and Eric to discuss the plan to move forward. Best course of action may be to enter from the exit side to obtain target depths of injection wells. Walk exit area with Eric and Justin. We will have a re-design meeting at Tarracon office tomorrow morning. There is a storm sewer in the area that will need to be located with a floating sonde prior to drilling being performed. 16:00 Directional Technologies returned backhoe and secured site. Directional Technologies offsite by 17:00. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #3

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Overcast, Highs upper 50s |

| | |
|---|---|
| **Date:** | 12/19/2018 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 12/17/2018 | 11:15 | 17:00 | 5.75 |
| 12/18/2018 | 7:00 | 17:00 | 10.00 |
| 12/19/2018 | 10:00 | 15:00 | 5.00 |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 20.75 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| **Total** | | | **0** | **580** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **17%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| No drilling performed today. Fusing pipe only. | Day 3. Directional Technologies arrived onsite at 10:00. Prior to arrive Kyle Carlton and Justin Acri met with Terry and Eric at the Terracon office to discuss next course of action. The revised drilling plan is to begin drilling on January 2nd near the exit location after the storm sewer has been cleared with the floating sonde. We will attempt entry exit well, but will have tooling for reaming to 8-inches for blind well options. Crew arrived on-site at 10:00 and began fusing pipe. No drilling performed today. 360 feet of screen and 220 feet of riser fused. Directional Technologies offsite by 15:00. Will return to the site on January 2. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #4

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Rain, 55 deg |

| | |
|---|---|
| **Date:** | 1/2/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/2/2019 | 11:00 | 16:00 | 5.00 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 5.00 |

:

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 290 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| **Total** | | | **0** | **580** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **17%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| No drilling performed today. Remobilization and setup rig at new entry location.. | Day 4. Directional Technologies arrived onsite at 1100. Terracon and private line locator successfully identified the location of storm sewer near the new entry locations. The storm sewer was identified at 7.5 feet BGS. The new bore plan will clear the storm sewer by passing over at 5 feet BGS. Directional Technologies relocated drill rig and vacuum tank trailer to the new entry area. Heavy rain in the afternoon. Decide to saw cut and excavate entry pit first thing tomorrow morning. Directional Technologies offsite at 16:00. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #5

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Light rain, overcast, 54 deg |

| | |
|---|---|
| **Date:** | 1/3/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/2/2019 | 11:00 | 16:00 | 5.00 |
| 1/3/2019 | 07:00 | 17:15 | 10.25 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 15.25 |

| **DTI Personnel on Site:** |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| **Mud Mixing** | **#** |
|---|---|
| Bentonite (50 lbs. units) | 3 |
| PAC (1 lb units) | 0 |
| | |

| **Water Usage** | |
|---|---|
| Mud Mixing | 1000 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Concrete Saw | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 170 | 350 | 49% | 100% | 0% | 0% | 0% | 0% | 25% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 350 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| **Total** | | | **170** | **700** | **24%** | **0%** | **0%** | **0%** | **0%** | **0%** | **21%** |

| **Ground Conditions and Fluid Notes:** | **Brief Daily Activities Summary:** |
|---|---|
| Varying ground conditions, obstruction encountered at 110 feet into bore. Able to navigate past obstruction by . | Day 5. Directional Technologies arrived onsite at 7:30. Health and safety meeting with Brian Brown. Proceed to saw cut and excavate entry pit. Attempt first bore, however, drill bit was pushed up by hard object at rod 2. On second attempt unable to gain enough pitch change with spade bit to maintain target depth to clear storm sewer. Trip out drill rods and switch to bog bit to gain more steering control. Able to clear storm sewer at 5' bgs target and continue bore. Drill rig down for approximately 1.5 hours due to starter issue. Resume drilling at 15:00, at approximately 110' into bore encounter obstruction. Felt like concrete foundation. Able to steer past obstruction by pulling back 4 rods and steering underneath obstruction. Drilled 170 total feet today. Directional Technologies offsite by 17:15. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #6

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear, sunny 60 deg |

| | |
|---|---|
| **Date:** | 1/4/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/2/2019 | 11:00 | 16:00 | 5.00 |
| 1/3/2019 | 07:00 | 17:15 | 10.25 |
| 1/4/2019 | 07:15 | 17:00 | 9.75 |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 25.00 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 0% | 0% | 0% | 0% | 33% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 350 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| **Total** | | | **350** | **700** | **50%** | **0%** | **0%** | **0%** | **0%** | **0%** | **25%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| Favorable drilling from 110' to 350'. Obtained target depths of screen. | Day 6. Directional Technologies arrived onsite at 7:15 Resume drilling of HIW-1. Drilling went smoothly from 170' to refusal at ~355'. Some inadvertent returns near rod 15 in asphalt area. Use vacuum trailer to contain. Refusal at approximately 7.5' below ground surface, and we suspected the foundation which caused us issues during entry. Used the backhoe to dig an excavation to attempt to expose bit for well. Backhoe going very slow through hard aggregate slag. Received Terracon approval to rent a mini excavator with hydraulic breaker to break through the aggregate slag and foundations to retrieve bit with an excavation to 8 feet deep. Began digging with hydraulic break/mini excavator at 15:00. obtained depth of ~7 feet, with shoring of excavation. Almost excavated to the bit, will resume excavation on Monday. Directional Technologies offsite by 17:00. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #7

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear, sunny 63 deg |

| | |
|---|---|
| **Date:** | 1/7/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 9.75 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 2 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 600 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 0% | 0% | 67% |
| HIW-2 | 2720 | Baroid Quick-bore | 0 | 350 | 0% | 100% | 0% | 0% | 0% | 0% | 17% |
| **Total** | | | **350** | **700** | **50%** | **0%** | **50%** | **50%** | **0%** | **0%** | **42%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| Back reaming and pull pipe today. | Day 7. Directional Technologies arrived onsite at 7:00 Resume excavation to expose bit. Use backhoe and hydraulic breaker on mini excavator to break through foundation that bit was hitting. Able to expose bit and advance bit to near surface of excavation. Break off bit and attach reamer. Finsh fusing pipe: 100' entry riser, 180' of screen, 100' tail riser. Attached shale traps and grout lines. Begin pulling pipe 14:00. Finished pulling pipe by 16:00. Entry grout tube successfully installed. Exit grout tube would not enter borehole due to rocky/foundation near bottom of the excavation. Will try to reinstall grout tubing tomorrow morning. Clean up inadvertant returns during backreaming near asphalt area around rod #15. Finished for the day ~ 16:45. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #8

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear, sunny 65 deg |

| | |
|---|---|
| **Date:** | 1/8/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| 1/8/2019 | 7:00 | 17:00 | 10.00 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 19.75 |

| **DTI Personnel on Site:** |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| **Mud Mixing** | **#** |
|---|---|
| Bentonite (50 lbs. units) | 1.5 |
| PAC (1 lb units) | 1 |
| | |

| **Water Usage** | |
|---|---|
| Mud Mixing | 400 |
| Well Dev. | 1700 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 100% | 50% | 92% |
| HIW-2 | 2720 | Baroid Quick-bore | 80 | 350 | 23% | 100% | 0% | 0% | 0% | 0% | 20% |
| **Total** | | | **430** | **700** | **61%** | **0%** | **50%** | **50%** | **50%** | **25%** | **56%** |

| **Ground Conditions and Fluid Notes:** | **Brief Daily Activities Summary:** |
|---|---|
| Began HIW-2, today, favorable ground conditions no obstructions within first 80 feet of drilling. | Day 8. Directional Technologies arrived onsite at 7:00 Sent Nick with truck and trailer to pick up additional well materials from Consolidated Pipe and Supply in Bessemer. Attempted to manually install grout tube for the tail riser into boring, however, it would not advance due to foundation/rocky ground at location of bit refusal 7.5' BGS. In order to create an effective seal on the exit riser of HIW-1, Directional Technologies highly recommended ordering 3 cubic yards of cement/grout to plug the entry side of the bore within the bottom of the excavation, Don and Terracon agreed, and delivery was scheduled for 14:00. Prior to cement/grout, Directional Technologies proceeded with well development of HIW-1. Performed 3 stage well development: 600 gallon initial boring flush with tap; 600 gallon Aqua-Clear clay dispersant solution flush; followed by final 500 gallon tap flush. Development water observed to be very clear during final flush, indicating good development. During well development some daylighting of drilling mud and development water was observed near asphalt area around rod 15-20. This area will need to be observed during water injection testing and during Regenesis injection. Directional Technologies will attempt to pour some grout in the visible cracks in the asphalt where daylighting was observed in an attempt to seal some of the fractures. Cement truck arrived onsite at approximately 14:00. Installed 3 cubic yard cement/grout plug within bottom of excavation to seal HIW-1 exit riser. Used backhoe to pack and smooth cement within the excavation. At approximately 15:30, prepped to begin pilot bore for HIW-2. Drilled 80 feet of HIW-2 pilot bore prior to shutting down for the day at 17:00 |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #9

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear, sunny 53 deg, windy |

| | |
|---|---|
| **Date:** | 1/9/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| 1/8/2019 | 7:00 | 17:00 | 10.00 |
| 1/9/2019 | 7:00 | 16:50 | 9.75 |
| | | | |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 29.50 |

| **DTI Personnel on Site:** |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| **Mud Mixing** | **#** |
|---|---|
| Bentonite (50 lbs. units) | 2.5 |
| PAC (1 lb units) | 0 |
| | |

| **Water Usage** | |
|---|---|
| Mud Mixing | 1300 |
| Well Dev. | 0 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 100% | 50% | 92% |
| HIW-2 | 2720 | Baroid Quick-bore | 335 | 335 | 100% | 100% | 0% | 0% | 0% | 0% | 33% |
| **Total** | | | **685** | **685** | **100%** | **0%** | **50%** | **50%** | **50%** | **25%** | **63%** |

| **Ground Conditions and Fluid Notes:** | **Brief Daily Activities Summary:** |
|---|---|
| Resumed drilling HIW-2. Good drilling conditions in native clay. No daylighting of drilling fluids. Very hard drilling on exit attempt through aggregate slag fill material. Refusal at 6.5 feet BGS. | Day 9. Directional Technologies arrived onsite at 7:00. Made preparations to resume drilling HIW-2. Mixed 900 gallons of drilling mud, planned remaining bore and curvature to reach target. Resumed drilling at 7:45. Drilling conditions favorable with target depths for screen obtained. No obstructions encountered, and no drilling fluid daylighting at surface during the bore. Began bore exit, and encountered refusal at approximate Rod 35.5, at 6.5 feet BGS. Obstruction similar to HIW-1, suspect a foundation. Use backhoe and mini excavator with hydraulic breaker to dig an exit pit for bit. Very hard packed fill material (aggregate slag). Excavated from 10:30 - 14:30. Also uncovered a concrete foundation with rebar. Removed drill bit and attached reamer. Finish well material preparation for installation. Made final fused connections and placed shale traps and grout tubing. Ready to pull pipe at 16:00, but would not be done before 17:00, so we will pull in HIW-2 first thing tomorrow morning. Remark all locate marks along bore paths within the asphalt area (truck traffic was wearing off the paint on the asphalt). Directional Technologies offsite by 16:50. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #10

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear, cold, high 45 |

| | |
|---|---|
| **Date:** | 1/10/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| 1/8/2019 | 7:00 | 17:00 | 10.00 |
| 1/9/2019 | 7:00 | 16:50 | 9.75 |
| 1/10/2019 | 7:00 | 17:00 | 10.00 |
| | | | |
| | | | |
| | | | |
| **Weekly Total** | | | 39.50 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 1 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 1400 |
| Other | 0 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 100% | 50% | 92% |
| HIW-2 | 2720 | Baroid Quick-bore | 335 | 335 | 100% | 100% | 100% | 100% | 100% | 50% | 92% |
| **Total** | | | **685** | **685** | **100%** | **0%** | **100%** | **100%** | **100%** | **50%** | **92%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| Reamed and installed HIW-2 today. Ground conditions favorable, no inadvertent returns (daylighting) observed during reaming or well development. | Day 10. Directional Technologies arrived onsite at 7:00. Health and Safety meeting with Meghan. Prepped to pull in HIW-2. Began pull at 8:00. At approximately 8:45, drill rig down to replace hydraulic line. Rig repair made and resumed pull at 11:15. HIW-2 successfully installed by 12:30. Prepare for HIW-2 development. 3 stage development: 1st flush: 490 gallons at 21 gpm. 2nd flush: 380 gallon solution of Aqua clear at 25 gpm. Final flush: 506 gallons at 28 gpm. Well development water observed to be clear of drilling fluids. No daylighting (inadvertent returns) observed anywhere along the bore path. Finished developing @ 15:20, prep to grout. Mixed 150 gallons of grout for grout seal, and pour into the bottom of the exit pit to seal exit riser. Directional Technologies to resume grouting tomorrow morning. Directional Technologies offsite by 17:00. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #11

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Clear cool, High 53 |

| | |
|---|---|
| **Date:** | 1/11/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| 1/8/2019 | 7:00 | 17:00 | 10.00 |
| 1/9/2019 | 7:00 | 16:50 | 9.75 |
| 1/10/2019 | 7:00 | 17:00 | 10.00 |
| 1/11/2019 | 7:15 | 17:15 | 10.00 |
| | | | |
| | | | |
| **Weekly Total** | | | 49.50 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other (grouting) | 350 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| John Dear 310 Backhoe | Sunbelt Rentals |
| Mini Excavator and Hydraulic Breaker | Sunbelt Rentals |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| HIW-2 | 2720 | Baroid Quick-bore | 335 | 335 | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Total** | | | **685** | **685** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| No drilling performed today. Finished grouting. | Day 11. Directional Technologies arrived onsite at 7:15. Health and Safety meeting with Meghan. Prepared for grouting. Mixed an additional 50 gallons of grout to top off grout in exit pit for HIW-2 where grout had settled. Mixed in an additional 30 gallons for HIW-1 entry pit and pumped through grout tube. Prepped to mix grout for Entry sides of HIW-1 and HIW-2. The grout pump had some issues with a blown cap. Threaded cap replaced and resumed grouting at 12:00. Pumped in good grout seals through tremie pipe on each well ~85 gallons each. Backfilled exit pit for HIW-2 with backhoe. Prepped HIW-1 and HIW-2 entry pits for vault installation by EPS on Monday. Mixed 5 gallons additional grout and poured into cracks in asphalt where daylighting was observed during drilling and development. Fuse on threaded wellhead fitting and cap to HIW-1. The horizontal wells are under some hydraulic groundwater pressure causing groundwater to flow out of the entry-side wellhead. Able to fuse on fitting by temporarily plugging well. Returned rental equipment to Sunbelt Rentals. Directional Technologies offsite by 17:15. Directional Technologies to fuse on final fittings tomorrow and perform injection tests at each well. |

DIRECTIONAL Technologies, Inc
Horizontal Remediation Wells

# Daily Field Report #12

| | |
|---|---|
| **Client:** | Terracon |
| **Site:** | ERP Coke |
| **Location:** | Birmingham, Alabama |
| **Weather:** | Overcast, High 50 F |

| | |
|---|---|
| **Date:** | 1/12/2019 |
| **Report by:** | Kyle Carlton |

**Hours on Site This Week:**

| Date | Start | Stop | Hours |
|---|---|---|---|
| 1/7/2019 | 7:00 | 16:45 | 9.75 |
| 1/8/2019 | 7:00 | 17:00 | 10.00 |
| 1/9/2019 | 7:00 | 16:50 | 9.75 |
| 1/10/2019 | 7:00 | 17:00 | 10.00 |
| 1/11/2019 | 7:15 | 17:15 | 10.00 |
| 1/12/2019 | 6:45 | 11:00 | 4.25 |
| | | | |
| **Weekly Total** | | | 53.75 |

| DTI Personnel on Site: |
|---|
| Kyle Carlton |
| Justin Acri |
| Nick Matthews |
| Mason Jones |
| |
| |
| |
| |
| |

| Mud Mixing | # |
|---|---|
| Bentonite (50 lbs. units) | 0 |
| PAC (1 lb units) | 0 |
| | |

| Water Usage | |
|---|---|
| Mud Mixing | 0 |
| Well Dev. | 0 |
| Other (injection test) | 1010 |

**Equipment on Site:**

| Code | Description |
|---|---|
| S10 | Tool Truck |
| A9 | Freightliner Mixing Truck |
| DW 2720 | Drill Rig |
| AT16 | Rig Trailer |
| V17 | Vac trailer 500 gallon |
| | |
| | |

**Rental Equipment & Subcontractors:**

| Equipment | Comments |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Progress:**

| Well | Rig | Mud Type | FT Drilled | FT Planned | Pilot Drilling | Fusing Well Materials | Reaming | Install Well | Well Dev. (Flushing) | Grouting | Percent Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HIW-1 | 2720 | Baroid Quick-bore | 350 | 350 | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| HIW-2 | 2720 | Baroid Quick-bore | 335 | 335 | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Total** | | | **685** | **685** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

| Ground Conditions and Fluid Notes: | Brief Daily Activities Summary: |
|---|---|
| No drilling performed today. Finished fusing wellhead fittings and performed injection testing. | Day 12. Directional Technologies arrived onsite at 6:45. Proceed to fuse on final wellhead fittings. Then begin injection test for HIW-2 at 7:56. Injected 506 gallons in 42 mins at an average of 12 gpm. Average pressure 6 psi, no daylighting observed anywhere along well path. Performed injection test for HIW-1. Injected 504 gallons in 37 mins at an average flow rate of 13.6 gpm. Average pressure 2 psi. Daylighting observed near the old railroad spur in the asphalt area where daylighting was previously observed during development and pilot bore advancement. Estimated 30 to 50 gallons daylighted through several locations approximately 15 to 25 lateral feet away from the HIW-1. Took pictures of daylighting area. 10:45 finished loading all equipment, rig, Kyle called Terry to check in with status report. EPS will be onsite at 9:00 Monday to install well vaults and build well pads. |

# APPENDIX B
# Regenesis Application Summary Report

REGENESIS
REMEDIATION SERVICES
Technology-Based Solutions for the Environment

**Global Headquarters**
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February 2, 2021

**REGENESIS Proposal No. DaP61066**

Bluestone Coke

3500 35th Ave N., Birmingham, AL 35207

**SUBJECT: Application Summary Report for Remedial Services at the Bluestone Coke Site**

Don Wiggins,

REGENESIS Remediation Services (RRS) has recently completed an *in-situ* injection application of RegenOx® and PetroCleanze™ at the Bluestone Coke located at 3500 35th Ave N., Birmingham, AL 35207. The goal of the remedial application was to remediate petroleum hydrocarbons. RRS employed *in-situ* chemical oxidation and enhanced desorption technologies to meet remediation goals.

RRS mobilized a support pickup truck, injection trailer, and personnel to the site to begin work over nine (9) days on November 13th, 2020 through November 22nd, 2020 and over four (4) additional days on January 26th, 2021 through January 29th, 2021. RRS staffed this project with an experienced Project Supervisor who ensured a safe, successful injection application. On Tuesday, November 13th, RRS began injecting PetroCleanze and testing the integrity of the injection wells. On Thursday, November 15th, RRS began injecting RegenOx Part A. Injection activities were paused Thursday afternoon, November 22nd, 2020. The RegenOx Part A application restarted on January 26th, 2021 and was completed January 29th, 2021. The site was restored to its previous conditions and the RRS team demobilized.

Please review the attached application summary page, injection log, and photo log for more detail on the application.

RRS appreciates the opportunity to work at this site with Terracon and Bluestone Coke. RRS will be available to interpret the field data as it is collected or answer any questions. If you need additional information regarding the application process or attached field notes, please contact Will Clogan at 724.766.1811, Bill Disselhorst at 630.740.8815, or Dominic Williams at 949.324.3194.

Sincerely,

Dominic Williams
Project Supervisor
REGENESIS Remediation Services

William Clogan

Will Clogan
East Region Project Manager
REGENESIS Remediation Services

cc: wdisselhorst@regenesis.com; cnorthington@regenesis.com; dpeterson@regenesis.com

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San Clemente, CA 92673
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REGENESIS
REMEDIATION SERVICES
Technology-Based Solutions for the Environment

# Application Summary Page

REGEN Ox  PETRO Enhanced Desorption CLEANZE™

## OVERVIEW

***Client:*** Bluestone Coke
***Client PM:*** Don Wiggins
***RRS Project Manager:*** Will Clogan
***Project Dates:*** 10/13/20-10/22/20
1/26/21-1/29/21

**Client:** Terracon
**Client PM:** Terry Rippstein
***Site Address:*** 3500 35th Avenue Birmingham, AL 35207
***Project Name:*** Bluestone Coke
***RRS Project Supervisor***: Dominic Williams

## TREATMENT TECHNOLOGY

REGENESIS Remediation Services (RRS) used the REGENESIS products RegenOx and PetroCleanze. RegenOx *in situ* chemical oxidation (ISCO) directly oxidizes contaminants while its unique catalytic component generates a range of highly oxidizing free radicals that rapidly and effectively destroy a range of target contaminants including both petroleum hydrocarbons and chlorinated compounds. RegenOx is an injectable, two-part ISCO reagent that features a solid sodium percarbonate based alkaline oxidant (Part A) resulting in a powerful contaminant destroying technology.

PetroCleanze is a customized formulation of the widely used RegenOx In Situ chemical oxidation (ISCO) technology. When applied, this two-part reagent generates detergent-like properties, significantly increasing the desorption rates of hydrocarbons bound in saturated soils. Once the hydrocarbons are liberated into the dissolved-phase, they are more readily available for removal using a range of physical recovery techniques. PetroCleanze is designed to increase the viability and efficiency of enhanced recovery techniques such as dual-phase extraction, vacuum enhanced extraction and pump and treat systems.

PetroCleanze is a patented alkaline surface catalyst system that is applied with RegenOx oxidizer complex (RegenOx Part A). Like RegenOx, PetroCleanze stimulates the rapid chemical oxidation of contaminants in situ. A further benefit is the generation of surfactants from the partial oxidation of hydrocarbons. Surfactants are formed upon alkaline oxidation of linear or branched hydrocarbons contaminants, which assist in the desorption of more contaminants from soil. This process enhances the ability to physically remove hydrocarbons from the contaminated subsurface by extraction or other methods.

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## APPLICATION

RRS applied the REGENESIS products RegenOx and PetroCleanze by mixing them in the RRS injection trailer and injected through the two (2) injection wells, HIW-1 and HIW-2. Mixing water was provided by Bluestone Coke via hydrant. RRS used a dual batch mixing system with 300-gallon tanks and pumped product using a positive displacement electrically powered pump.

During the first phase of injections, Injection pressures were generally observed between 0 and 26 pounds per square inch (PSI) and flow rates were maintained between 0 and 10 gallons per minute (GPM). Injection was completed by pumping on up to four (4) lines (2 per well) at a time using the RRS injection trailer manifold system. Product surfacing was observed generally along the railroad spur, Northwest of the truck wheel cleaning apparatus, throughout the project. However, surfacing was not limited to this area, and was also observed through several cracks in the asphalt in the same area. In most cases of surfacing, patching was not possible. A berm of bentonite and soil was created to restrain the movement of surfaced material and a sump pump was utilized to transfer this material into totes, which were then taken to the water treatment facility on site at the direction of Bluestone Coke. During the application RRS observed the nearby monitoring wells to ensure the targeted radial distribution was being met.

During the second phase of injections, injection pressures were observed between 4 and 17 PSI and flow rates were between 1.58 and 2.74 GPM. Injections were completed by alternating ends of the two wells that were injected upon each day. To try and limit the amount of surfaced material the injection concentration was increased from 6% weight/vol solution to 10% during injections. Surfacing was observed along the railroad spur and from the cracks in the surrounding concrete. The bentonite berm was still in place from the first phase of injections and was utilized again for the second round of injections. As surfaced material collected in the corner of the bermed area, a sump pump transferred it into totes provided by ERP. Surfaced material totaled roughly 3,300 gallons.

## PetroCleanze TREATMENT AREA – HIW-1A, HIW-1B, HIW-2A, and HIW-2B

**Total Amount Applied:**

| | |
|---|---|
| PetroCleanze | 6,760 lbs |

**Amount Applied Per Well:**

| | |
|---|---|
| PetroCleanze | 3,380 lbs |

A total of 16,092 gallons of remedial reagent solution was applied in this treatment area.

***Application Method:*** Injection Wells
***Injection Depth:*** 6 to 9 feet below ground surface.
***Number of Injection Points:*** 4 (2 connections per well)

***Average Injection Flowrate:*** 4.9 GPM

***Average Injection Pressure:*** 30.8 PSI

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***General Observations:*** Surfacing was observed from cracks in the asphalt, generally occurring along the railroad spur, in the same area of daylighting as noted in the initial well installation test.

***Deviations from Proposal:***

1. No design changes were made during this portion of the project.

*Please see attached Table 1 for more details on injection flow rates and pressures observed. Please see attached Figure 1 - Injection Locations Map for details on Injection Point locations.*

## RegenOx TREATMENT AREA – HIW-1A, HIW-1B, HIW-2A, and HIW-2B (Phase 1)

**Total Amount Applied:**

| | |
|---|---|
| RegenOx part A | 5,442 lbs |

**Amount Applied Per Point:**

| | |
|---|---|
| RegenOx part A | 2,721 lbs |

A total of 10,488 gallons of remedial reagent solution was applied in this treatment area.

***Application Method:*** Injection Wells
***Injection Depth:*** 6 to 9 feet below ground surface.
***Number of Injection Points:*** 4 (2 connections per well)

***Average Injection Flowrate:*** 1.4 GPM

***Average Injection Pressure:*** 13.9 PSI

***General Observations:*** Surfacing was observed from cracks in the asphalt, generally occurring along the railroad spur, in the same area of daylighting as noted in the initial well installation test. Surfacing was more violent during this phase of the injection.

***Deviations from Proposal:***

1. Concentration was increased before beginning this portion of the injection to alleviate the surfacing issues observed while injecting PetroCleanze.

*Please see attached Table 2 for more details on injection flow rates and pressures observed. Please see attached Figure 1 - Injection Locations Map for details on Injection Point locations.*

## RegenOx TREATMENT AREA – HIW-1A, HIW-1B, HIW-2A, and HIW-2B (Phase 2)

**Total Amount Applied:**

| | |
|---|---|
| RegenOx part A | 2,377 lbs |

**Amount Applied Per Point:**

| | |
|---|---|
| RegenOx part A | 2,321 lbs |

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A total of 6,181 gallons of remedial reagent solution was applied in this treatment area.

***Application Method:*** Injection Wells
***Injection Depth:*** 6 to 9 feet below ground surface.
***Number of Injection Points:*** 4 (2 connections per well)

***Average Injection Flowrate:*** 2.3 GPM

***Average Injection Pressure:*** 7.9 PSI

***General Observations:*** Surfacing was observed from cracks in the asphalt, generally occurring along the railroad spur, in the same area of daylighting as noted in the initial well installation test. Surfacing in this phase of injections brought up more silt than previous surfacing events.

***Deviations from Proposal:***

1. Concentration was increased to 6% before beginning this phase of the injection to alleviate the surfacing issues observed while injecting PetroCleanze.
2. During injections, the concentration was increased to 8% and subsequently 10% to limit surfacing in the area.

*Please see attached Table 3 for more details on injection flow rates and pressures observed. Please see attached Figure 1 - Injection Locations Map for details on Injection Point locations.*

PETRO CLEANZE Enhanced Desorption

**Terracon-Bluestone Coke**
**PetroCleanze Injection Summary Log**
**HIW-1 and HIW-2**
**Table 1**

REGENESIS REMEDIATION SERVICES Technology-Based Solutions for the Environment

| Injection Point | Date | Time | Injection Depth (feet) | Injection Pressure (psi) | Flow Rate (gpm) | Volume of RegenOx Injected | | | Total Gallons Per Location | Pounds of PetroCleanze Per Location | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Beginning Flow Meter (gal) | Ending Flow Meter (gal) | Gallons Injected Per Interval | | | |
| HIW-1A | 10/13/2020 | 13:41 | 9-7 | 4 | 2.25 | 0.00 | 78.87 | 78.87 | 3956 | 1662 | Well integrity test begins. Every 158 gallons, the cumulative flow rate is increased to determine a safe operating flow rate per well. |
| | 10/13/2020 | 14:16 | | 8 | 3.21 | 78.87 | 157.73 | 78.86 | | | |
| | 10/13/2020 | 14:40 | | 14 | 4.22 | 157.73 | 236.60 | 78.87 | | | |
| | 10/13/2020 | 14:56 | | 18 | 5.13 | 236.60 | 315.47 | 78.87 | | | |
| | 10/13/2020 | 15:14 | | 20 | 6.16 | 315.47 | 394.34 | 78.87 | | | |
| | 10/13/2020 | 15:28 | | 28 | 7.07 | 394.34 | 473.21 | 78.87 | | | Well integrity test completed. Achieved 14 cumulative gpm at a cumulative pressure of 80 psi. |
| | 10/13/2020 | 15:43 | | 10 | 3.72 | 473.21 | 512.64 | 39.43 | | | |
| | 10/13/2020 | 16:04 | | 14 | 4.53 | 512.64 | 552.07 | 39.43 | | | |
| | 10/13/2020 | 16:11 | | 18 | 4.99 | 552.07 | 591.50 | 39.43 | | | |
| | 10/13/2020 | 16:20 | | 18 | 4.99 | 591.50 | 630.93 | 39.43 | | | |
| | 10/14/2020 | 8:17 | | 19 | 5.98 | 630.93 | 630.93 | 0.00 | | | |
| | 10/14/2020 | 9:29 | | 18 | 5.62 | 630.93 | 1041.18 | 410.25 | | | |
| | 10/14/2020 | 10:45 | | 16 | 5.10 | 1041.18 | 1451.27 | 410.09 | | | Old soil bore in parking lot/rail spur area was left unpatched and indicated it might become a surfacing risk. Patched with bentonite chips, continued injection. |
| | 10/14/2020 | 12:01 | | 16 | 5.05 | 1451.27 | 1814.04 | 362.77 | | | Surfacing observed from crack in asphalt along rail line ~30 ft SE from designated daylighting area at ~3800 gal injected on the day, cumulative. |
| | 10/14/2020 | 13:19 | | 18 | 5.22 | 1814.04 | 2161.04 | 347.00 | | | |
| | 10/14/2020 | 14:44 | | 17 | 5.08 | 2161.04 | 2555.35 | 394.31 | | | |
| | 10/14/2020 | 15:31 | | 16 | 5.06 | 2555.35 | 2713.08 | 157.73 | | | Surfacing continued through EOD at a manageable level. |
| | 10/15/2020 | 8:23 | | 19 | 5.22 | 2713.08 | 2713.08 | 0.00 | | | |
| | 10/15/2020 | 9:28 | | 23 | 5.62 | 2713.08 | 3123.17 | 410.09 | | | Surfacing observed from same cracks in asphalt along rail line ~30 to ~50 ft SE from designated daylighting area at ~1600 gal injected on the day, cumulative. Very small amount of potential petroleum free product pushing through asphalt in several spots, ~25 ft SW of TMW-2 observed at same time. |
| | 10/15/2020 | 11:53 | | 20 | 5.30 | 3123.17 | 3501.71 | 378.54 | | | |
| | 10/15/2020 | 13:26 | | 21 | 5.00 | 3501.71 | 3955.96 | 454.25 | | | |
| | | | | | | 3955.96 | | 0.00 | | | |
| | | | | | | 0.00 | | 0.00 | | | |
| | | | | | | 0.00 | | 0.00 | | | |
| | | | | | | 0.00 | | 0.00 | | | |
| HIW-1B | 10/13/2020 | 13:42 | 9-7 | 6 | 2.06 | 0.00 | 78.87 | 78.87 | 4088 | 1717 | Well integrity test begins. Every 158 gallons, the cumulative flow rate is increased to determine a safe operating flow rate per well. |
| | 10/13/2020 | 14:16 | | 16 | 3.16 | 78.87 | 157.73 | 78.86 | | | |
| | 10/13/2020 | 14:41 | | 24 | 4.31 | 157.73 | 236.60 | 78.87 | | | |
| | 10/13/2020 | 14:57 | | 34 | 5.17 | 236.60 | 315.47 | 78.87 | | | |
| | 10/13/2020 | 15:14 | | 44 | 6.18 | 315.47 | 394.34 | 78.87 | | | |
| | 10/13/2020 | 15:28 | | 54 | 7.07 | 394.34 | 473.21 | 78.87 | | | Well integrity test completed. Achieved 14 cumulative gpm at a cumulative pressure of 80 psi. |
| | 10/13/2020 | 15:43 | | 18 | 3.98 | 473.21 | 512.64 | 39.43 | | | |
| | 10/13/2020 | 16:05 | | 22 | 4.55 | 512.64 | 552.07 | 39.43 | | | |
| | 10/13/2020 | 16:11 | | 24 | 4.91 | 552.07 | 591.50 | 39.43 | | | |
| | 10/13/2020 | 16:20 | | 26 | 4.91 | 591.50 | 630.93 | 39.43 | | | |
| | 10/14/2020 | 8:18 | | 26 | 5.25 | 630.93 | 630.93 | 0.00 | | | |
| | 10/14/2020 | 9:29 | | 30 | 5.44 | 630.93 | 1009.47 | 378.54 | | | |
| | 10/14/2020 | 10:46 | | 30 | 5.45 | 1009.47 | 1388.01 | 378.54 | | | Old soil bore in parking lot/rail spur area was left unpatched and indicated it might become a surfacing risk. Patched with bentonite chips, continued injection. |
| | 10/14/2020 | 12:02 | | 30 | 5.54 | 1388.01 | 1813.87 | 425.86 | | | Surfacing observed from crack in asphalt along rail line ~30 ft SE from designated daylighting area at ~3800 gal injected on the day, cumulative. |
| | 10/14/2020 | 13:20 | | 33 | 5.43 | 1813.87 | 2255.50 | 441.63 | | | |
| | 10/14/2020 | 14:45 | | 30 | 5.09 | 2255.50 | 2649.81 | 394.31 | | | |
| | 10/14/2020 | 15:31 | | 30 | 5.14 | 2649.81 | 2807.54 | 157.73 | | | Surfacing continued through EOD at a manageable level. |
| | 10/15/2020 | 8:22 | | 28 | 5.28 | 2807.54 | 2807.54 | 0.00 | | | |
| | 10/15/2020 | 9:28 | | 32 | 5.42 | 2807.54 | 3186.08 | 378.54 | | | Surfacing observed from same cracks in asphalt along rail line ~30 to ~50 ft SE from designated daylighting area at ~1600 gal injected on the day, cumulative. Very small amount of potential petroleum free product pushing through asphalt in several spots, ~25 ft SW of TMW-2 observed at same time. |
| | 10/15/2020 | 11:53 | | 34 | 5.44 | 3186.08 | 3596.17 | 410.09 | | | |
| | 10/15/2020 | 13:26 | | 34 | 5.38 | 3596.17 | 4088.27 | 492.10 | | | |
| HIW-2A | 10/13/2020 | 11:38 | 9-6 | 12 | 2.15 | 0.00 | 78.87 | 78.87 | 6583 | 2766 | Well integrity test begins. Every 158 gallons, the cumulative flow rate is increased to determine a safe operating flow rate per well. |
| | 10/13/2020 | 12:13 | | 17 | 3.12 | 78.87 | 157.73 | 78.86 | | | |
| | 10/13/2020 | 12:37 | | 26 | 5.72 | 157.73 | 236.60 | 78.87 | | | |
| | 10/13/2020 | 12:55 | | 25 | 5.03 | 236.60 | 315.47 | 78.87 | | | |
| | 10/13/2020 | 13:11 | | 34 | 7.42 | 315.47 | 394.34 | 78.87 | | | |
| | 10/13/2020 | 13:26 | | 44 | 9.00 | 394.34 | 473.21 | 78.87 | | | Well integrity test completed. Achieved 14 cumulative gpm at a cumulative pressure of 60 psi. |
| | 10/13/2020 | 15:42 | | 18 | 3.94 | 473.21 | 512.64 | 39.43 | | | |
| | 10/13/2020 | 16:03 | | 26 | 6.06 | 512.64 | 552.07 | 39.43 | | | |
| | 10/13/2020 | 16:11 | | 30 | 6.82 | 552.07 | 591.50 | 39.43 | | | |
| | 10/13/2020 | 16:20 | | 30 | 6.92 | 591.50 | 630.93 | 39.43 | | | |
| | 10/14/2020 | 8:17 | | 32 | 7.02 | 630.93 | 630.93 | 0.00 | | | |
| | 10/14/2020 | 9:29 | | 34 | 7.72 | 630.93 | 1088.27 | 457.34 | | | |
| | 10/14/2020 | 10:44 | | 38 | 8.70 | 1088.27 | 1719.17 | 630.90 | | | Old soil bore in parking lot/rail spur area was left unpatched and indicated it might become a surfacing risk. Patched with bentonite chips, continued injection. |
| | 10/14/2020 | 12:01 | | 40 | 8.80 | 1719.17 | 2397.39 | 678.22 | | | Surfacing observed from crack in asphalt along rail line ~30 ft SE from designated daylighting area at ~3800 gal injected on the day, cumulative. |
| | 10/14/2020 | 13:19 | | 42 | 9.15 | 2397.39 | 3107.15 | 709.76 | | | |
| | 10/14/2020 | 14:44 | | 46 | 9.51 | 3107.15 | 3848.46 | 741.31 | | | |
| | 10/14/2020 | 15:30 | | 46 | 9.72 | 3848.46 | 4138.67 | 290.21 | | | Surfacing continued through EOD at a manageable level. |
| | 10/15/2020 | 8:22 | | 42 | 8.72 | 4138.67 | 4138.67 | 0.00 | | | |
| | 10/15/2020 | 9:27 | | 46 | 9.66 | 4138.67 | 4864.21 | 725.54 | | | Surfacing observed from same cracks in asphalt along rail line ~30 to ~50 ft SE from designated daylighting area at ~1600 gal injected on the day, cumulative. Very small amount of potential petroleum free product pushing through asphalt in several spots, ~25 ft SW of TMW-2 observed at same time. |
| | 10/15/2020 | 11:52 | | 52 | 10.48 | 4864.21 | 5637.06 | 772.85 | | | |
| | 10/15/2020 | 13:25 | | 54 | 10.32 | 5637.06 | 6583.41 | 946.35 | | | |
| HIW-2B | 10/13/2020 | 11:38 | 9-6 | 8 | 2.18 | 0.00 | 78.87 | 78.87 | 1465 | 615 | Well integrity test begins. Every 158 gallons, the cumulative flow rate is increased to determine a safe operating flow rate per well. |
| | 10/13/2020 | 12:14 | | 25 | 3.16 | 78.87 | 157.73 | 78.86 | | | |
| | 10/13/2020 | 12:38 | | 60 | 2.56 | 157.73 | 236.60 | 78.87 | | | |
| | 10/13/2020 | 12:55 | | 58 | 5.08 | 236.60 | 315.47 | 78.87 | | | |
| | 10/13/2020 | 13:11 | | 32 | 4.85 | 315.47 | 394.34 | 78.87 | | | |
| | 10/13/2020 | 13:26 | | 42 | 4.81 | 394.34 | 473.21 | 78.87 | | | Well integrity test completed. Achieved 14 cumulative gpm at a cumulative pressure of 60 psi. |
| | 10/13/2020 | 15:43 | | 28 | 3.54 | 473.21 | 512.64 | 39.43 | | | |
| | 10/13/2020 | 16:03 | | 46 | 3.25 | 512.64 | 552.07 | 39.43 | | | |
| | 10/13/2020 | 16:11 | | 52 | 3.40 | 552.07 | 591.50 | 39.43 | | | |
| | 10/13/2020 | 16:20 | | 52 | 3.21 | 591.50 | 630.93 | 39.43 | | | |
| | 10/14/2020 | 8:17 | | 40 | 3.01 | 630.93 | 630.93 | 0.00 | | | |
| | 10/14/2020 | 9:29 | | 40 | 2.20 | 630.93 | 962.35 | 331.42 | | | |
| | 10/14/2020 | 10:45 | | 46 | 1.51 | 962.35 | 1120.08 | 157.73 | | | Old soil bore in parking lot/rail spur area was left unpatched and indicated it might become a surfacing risk. Patched with bentonite chips, continued injection. |
| | 10/14/2020 | 12:01 | | 48 | 1.29 | 1120.08 | 1230.49 | 110.41 | | | Surfacing observed from crack in asphalt along rail line ~30 ft SE from designated daylighting area at ~3800 gal injected on the day, cumulative. |
| | 10/14/2020 | 13:19 | | 52 | 1.02 | 1230.49 | 1309.35 | 78.86 | | | |
| | 10/14/2020 | 14:44 | | 50 | 0.72 | 1309.35 | 1356.67 | 47.32 | | | |
| | 10/14/2020 | 15:31 | | 48 | 0.53 | 1356.67 | 1381.91 | 25.24 | | | Surfacing continued through EOD at a manageable level. |
| | 10/15/2020 | 8:22 | | 36 | 1.84 | 1381.91 | 1381.91 | 0.00 | | | |
| | 10/15/2020 | 9:27 | | 38 | 0.64 | 1381.91 | 1445.00 | 63.09 | | | Surfacing observed from same cracks in asphalt along rail line ~30 to ~50 ft SE from designated daylighting area at ~1600 gal injected on the day, cumulative. Very small amount of potential petroleum free product pushing through asphalt in several spots, ~25 ft SW of TMW-2 observed at same time. |
| | 10/15/2020 | 11:52 | | 46 | 0.25 | 1445.00 | 1464.77 | 19.77 | | | |
| | 10/15/2020 | 13:25 | | 48 | 0.00 | 1464.77 | 1464.77 | 0.00 | | | |

| Total Gallons: | Total Lbs. of PetroCleanze: |
|---|---|
| 16092 | 6760 |

REGEN Ox

**Terracon-Bluestone Coke**
**RegenOx Injection Summary Log**
**HW-1 and HW-2**
**Table 2**

REGENESIS REMEDIATION SERVICES
Technology-Based Solutions for the Environment

| Injection Point | Date | Time | Injection Depth (feet) | Injection Pressure (psi) | Flow Rate (gpm) | Volume of RegenOx Injected | | | Total Gallons Per Location | Pounds of Part A Per Location | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Beginning Flow Meter (gal) | Ending Flow Meter (gal) | Gallons Injected Per Interval | | | |
| HW-1A | 10/15/2020 | 14:31 | 9-7 | 8 | 3.25 | 0.00 | 80.18 | 80.18 | 3597 | 1866 | Surfacing observed in same area, increasing in degree as more volume injected. |
| | 10/15/2020 | 16:00 | | 8 | 2.20 | 80.18 | 240.54 | 160.36 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/16/2020 | 11:18 | | 4 | 1.02 | 240.54 | 333.05 | 92.51 | | | |
| | 10/16/2020 | 13:47 | | 11 | 2.15 | 333.05 | 487.24 | 154.19 | | | Sufacing observed from same areas after ~300 gallons injected, cumulative. Manageageable with containment and pumping system set up earlier in day. During this time, HW-2 then HW-1 were each separately injected with 300 gallons to determine if surfacing was preferential to a specific well. |
| | 10/16/2020 | 15:14 | | 10 | 0.98 | 487.24 | 553.00 | 65.76 | | | Surfacing continued through EOD at a manageable level. |
| | 10/17/2020 | 8:22 | | 8 | 1.76 | 553.00 | 639.35 | 86.35 | | | |
| | 10/17/2020 | 9:18 | | 14 | 2.15 | 639.35 | 750.37 | 111.02 | | | |
| | 10/17/2020 | 10:12 | | 18 | 3.04 | 750.37 | 904.56 | 154.19 | | | |
| | 10/17/2020 | 11:13 | | 13 | 1.57 | 904.56 | 984.74 | 80.18 | | | |
| | 10/17/2020 | 12:07 | | 14 | 1.56 | 984.74 | 1068.00 | 83.26 | | | |
| | 10/17/2020 | 12:59 | | 16 | 1.57 | 1068.00 | 1150.01 | 82.01 | | | |
| | 10/17/2020 | 13:46 | | 15 | 1.54 | 1150.01 | 1228.19 | 78.18 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/19/2020 | 8:52 | | 8 | 0.96 | 1228.19 | 1299.12 | 70.93 | | | |
| | 10/19/2020 | 9:55 | | 12 | 1.10 | 1299.12 | 1376.22 | 77.10 | | | |
| | 10/19/2020 | 11:43 | | 12 | 1.10 | 1376.22 | 1453.32 | 77.10 | | | |
| | 10/19/2020 | 12:50 | | 13 | 0.86 | 1453.32 | 1521.16 | 67.84 | | | |
| | 10/19/2020 | 14:01 | | 11 | 1.08 | 1521.16 | 1598.26 | 77.10 | | | Surfacing continued through EOD at a manageable level. |
| | 10/20/2020 | 8:18 | | 4 | 1.08 | 1598.26 | 1675.36 | 77.10 | | | |
| | 10/20/2020 | 9:24 | | 14 | 1.16 | 1675.36 | 1752.46 | 77.10 | | | |
| | 10/20/2020 | 12:49 | | 13 | 2.25 | 1752.46 | 2215.03 | 462.57 | | | |
| | 10/20/2020 | 16:18 | | 12 | 2.15 | 2215.03 | 2523.41 | 308.38 | | | Surfacing continued through EOD at a manageable level. |
| | 10/21/2020 | 8:36 | | 6 | 0.96 | 2523.41 | 2588.17 | 64.76 | | | |
| | 10/21/2020 | 13:01 | | 14 | 2.25 | 2588.17 | 3205.77 | 617.60 | | | |
| | 10/21/2020 | 14:48 | | 14 | 2.21 | 3205.77 | 3359.69 | 153.92 | | | Surfacing continued through EOD at a manageable level. |
| | 10/22/2020 | 8:11 | | 10 | 1.31 | 3359.69 | 3442.95 | 83.26 | | | |
| | 10/22/2020 | 9:47 | | 12 | 2.42 | 3442.95 | 3597.14 | 154.19 | | | |
| HW-1B | 10/15/2020 | 14:31 | 9-7 | 15 | 3.03 | 0.00 | 74.01 | 74.01 | 1647 | 855 | Surfacing observed in same area, increasing in degree as more volume injected. |
| | 10/15/2020 | 16:00 | | 14 | 2.01 | 74.01 | 222.03 | 148.02 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/16/2020 | 11:18 | | 6 | 1.00 | 222.03 | 283.71 | 61.68 | | | |
| | 10/16/2020 | 13:48 | | 14 | 2.10 | 283.71 | 437.90 | 154.19 | | | Sufacing observed from same areas after ~300 gallons injected, cumulative. Manageageable with containment and pumping system set up earlier in day. During this time, HW-2 then HW-1 were each separately injected with 300 gallons to determine if surfacing was preferential to a specific well. |
| | 10/16/2020 | 15:14 | | 12 | 1.28 | 437.90 | 526.33 | 88.43 | | | Surfacing continued through EOD at a manageable level. |
| | 10/17/2020 | 8:22 | | 8 | 1.52 | 526.33 | 594.17 | 67.84 | | | |
| | 10/17/2020 | 9:18 | | 16 | 0.88 | 594.17 | 637.34 | 43.17 | | | |
| | 10/17/2020 | 10:12 | | 18 | 0.00 | 637.34 | 637.34 | 0.00 | | | |
| | 10/17/2020 | 11:14 | | 16 | 1.47 | 637.34 | 711.35 | 74.01 | | | |
| | 10/17/2020 | 12:07 | | 16 | 1.42 | 711.35 | 782.28 | 70.93 | | | |
| | 10/17/2020 | 12:59 | | 16 | 1.53 | 782.28 | 859.48 | 77.20 | | | |
| | 10/17/2020 | 13:45 | | 16 | 1.47 | 859.48 | 931.49 | 72.01 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/19/2020 | 8:52 | | 12 | 1.14 | 931.49 | 1014.75 | 83.26 | | | |
| | 10/19/2020 | 9:55 | | 14 | 1.12 | 1014.75 | 1091.85 | 77.10 | | | |
| | 10/19/2020 | 11:43 | | 18 | 1.10 | 1091.85 | 1168.95 | 77.10 | | | |
| | 10/19/2020 | 12:50 | | 16 | 1.12 | 1168.95 | 1255.30 | 86.35 | | | |
| | 10/19/2020 | 14:01 | | 18 | 1.08 | 1255.30 | 1332.40 | 77.10 | | | Surfacing continued through EOD at a manageable level. |
| | 10/20/2020 | 8:18 | | 6 | 1.10 | 1332.40 | 1409.50 | 77.10 | | | |
| | 10/20/2020 | 9:24 | | 14 | 1.20 | 1409.50 | 1486.60 | 77.10 | | | |
| | 10/20/2020 | 12:49 | | 12 | 0.00 | 1486.60 | 1486.60 | 0.00 | | | |
| | 10/20/2020 | 16:18 | | 14 | 0.00 | 1486.60 | 1486.60 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/21/2020 | 8:36 | | 8 | 1.29 | 1486.60 | 1576.03 | 89.43 | | | |
| | 10/21/2020 | 13:01 | | 16 | 0.00 | 1576.03 | 1576.03 | 0.00 | | | |
| | 10/21/2020 | 14:48 | | 15 | 0.00 | 1576.03 | 1576.03 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/22/2020 | 8:11 | | 8 | 1.09 | 1576.03 | 1646.96 | 70.93 | | | |
| | 10/22/2020 | 9:47 | | 14 | 0.00 | 1646.96 | 1646.96 | 0.00 | | | |
| HW-2A | 10/15/2020 | 14:31 | 9-6 | 26 | 5.61 | 0.00 | 144.94 | 144.94 | 4709 | 2443 | Surfacing observed in same area, increasing in degree as more volume injected. |
| | 10/15/2020 | 16:00 | | 20 | 4.20 | 144.94 | 453.32 | 308.38 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/16/2020 | 11:18 | | 10 | 0.99 | 453.32 | 561.25 | 107.93 | | | |
| | 10/16/2020 | 12:52 | | 18 | 3.88 | 561.25 | 846.13 | 284.88 | | | Sufacing observed from same areas after ~300 gallons injected, cumulative. Manageageable with containment and pumping system set up earlier in day. During this time, HW-2 then HW-1 were each separately injected with 300 gallons to determine if surfacing was preferential to a specific well. |
| | 10/16/2020 | 15:13 | | 18 | 2.18 | 846.13 | 995.24 | 149.11 | | | Surfacing continued through EOD at a manageable level. |
| | 10/17/2020 | 8:22 | | 14 | 2.11 | 995.24 | 1100.09 | 104.85 | | | |
| | 10/17/2020 | 9:18 | | 16 | 3.08 | 1100.09 | 1254.28 | 154.19 | | | |
| | 10/17/2020 | 10:12 | | 14 | 2.14 | 1254.28 | 1349.88 | 95.60 | | | |
| | 10/17/2020 | 11:14 | | 16 | 2.78 | 1349.88 | 1488.65 | 138.77 | | | |
| | 10/17/2020 | 12:07 | | 16 | 2.88 | 1488.65 | 1633.59 | 144.94 | | | |
| | 10/17/2020 | 12:58 | | 16 | 3.05 | 1633.59 | 1787.78 | 154.19 | | | |
| | 10/17/2020 | 13:46 | | 16 | 3.05 | 1787.78 | 1938.89 | 151.11 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/19/2020 | 8:52 | | 10 | 2.09 | 1938.89 | 2093.08 | 154.19 | | | |
| | 10/19/2020 | 9:55 | | 14 | 2.08 | 2093.08 | 2247.27 | 154.19 | | | |
| | 10/19/2020 | 11:43 | | 16 | 1.24 | 2247.27 | 2339.78 | 92.51 | | | |
| | 10/19/2020 | 12:50 | | 16 | 1.81 | 2339.78 | 2469.30 | 129.52 | | | |
| | 10/19/2020 | 14:01 | | 16 | 2.21 | 2469.30 | 2623.49 | 154.19 | | | Surfacing continued through EOD at a manageable level. |
| | 10/20/2020 | 8:18 | | 10 | 2.26 | 2623.49 | 2777.68 | 154.19 | | | |
| | 10/20/2020 | 9:24 | | 14 | 2.31 | 2777.68 | 2931.87 | 154.19 | | | |
| | 10/20/2020 | 12:50 | | 16 | 2.24 | 2931.87 | 3394.44 | 462.57 | | | |
| | 10/20/2020 | 16:18 | | 16 | 2.18 | 3394.44 | 3702.82 | 308.38 | | | Surfacing continued through EOD at a manageable level. |
| | 10/21/2020 | 8:36 | | 9 | 1.22 | 3702.82 | 3786.08 | 83.26 | | | |
| | 10/21/2020 | 13:00 | | 17 | 2.28 | 3786.08 | 4403.68 | 617.60 | | | |
| | 10/21/2020 | 14:47 | | 15 | 2.20 | 4403.68 | 4557.87 | 154.19 | | | Surfacing continued through EOD at a manageable level. |
| | 10/22/2020 | 8:11 | | 0 | 0.98 | 4557.87 | 4625.71 | 67.84 | | | |
| | 10/22/2020 | 9:46 | | 14 | 1.30 | 4625.71 | 4708.97 | 83.26 | | | |
| HW-2B | 10/15/2020 | 14:31 | 9-6 | 26 | 0.47 | 0.00 | 9.25 | 9.25 | 535 | 278 | Surfacing observed in same area, increasing in degree as more volume injected. |
| | 10/15/2020 | 16:00 | | 20 | 0.00 | 9.25 | 9.25 | 0.00 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/16/2020 | 11:18 | | 9 | 0.90 | 9.25 | 55.51 | 46.26 | | | |
| | 10/16/2020 | 12:52 | | 18 | 0.40 | 55.51 | 84.88 | 29.37 | | | Sufacing observed from same areas after ~300 gallons injected, cumulative. Manageageable with containment and pumping system set up earlier in day. During this time, HW-2 then HW-1 were each separately injected with 300 gallons to determine if surfacing was preferential to a specific well. |
| | 10/16/2020 | 15:14 | | 15 | 0.00 | 84.88 | 84.88 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/17/2020 | 8:22 | | 12 | 1.02 | 84.88 | 134.22 | 49.34 | | | |
| | 10/17/2020 | 9:18 | | 18 | 0.00 | 134.22 | 134.22 | 0.00 | | | |
| | 10/17/2020 | 10:12 | | 19 | 1.14 | 134.22 | 192.81 | 58.59 | | | |
| | 10/17/2020 | 11:14 | | 18 | 0.41 | 192.81 | 208.23 | 15.42 | | | |
| | 10/17/2020 | 12:07 | | 18 | 0.10 | 208.23 | 217.48 | 9.25 | | | |
| | 10/17/2020 | 12:58 | | 18 | 0.00 | 217.48 | 217.48 | 0.00 | | | |
| | 10/17/2020 | 13:46 | | 19 | 0.10 | 217.48 | 220.56 | 3.08 | | | Surfacing continued through EOD at a barely manageable level. |
| | 10/19/2020 | 8:52 | | 14 | 0.00 | 220.56 | 220.56 | 0.00 | | | |
| | 10/19/2020 | 9:55 | | 18 | 0.00 | 220.56 | 220.56 | 0.00 | | | |
| | 10/19/2020 | 11:43 | | 18 | 0.88 | 220.56 | 282.24 | 61.68 | | | |
| | 10/19/2020 | 12:50 | | 18 | 0.30 | 282.24 | 306.91 | 24.67 | | | |
| | 10/19/2020 | 14:01 | | 21 | 0.00 | 306.91 | 306.91 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/20/2020 | 8:18 | | 10 | 0.00 | 306.91 | 306.91 | 0.00 | | | |
| | 10/20/2020 | 9:24 | | 16 | 0.00 | 306.91 | 306.91 | 0.00 | | | |
| | 10/20/2020 | 12:50 | | 17 | 0.00 | 306.91 | 306.91 | 0.00 | | | |
| | 10/20/2020 | 16:18 | | 17 | 0.00 | 306.91 | 306.91 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/21/2020 | 8:36 | | 11 | 1.01 | 306.91 | 377.84 | 70.93 | | | |
| | 10/21/2020 | 13:01 | | 18 | 0.00 | 377.84 | 377.84 | 0.00 | | | |
| | 10/21/2020 | 14:47 | | 17 | 0.00 | 377.84 | 377.84 | 0.00 | | | Surfacing continued through EOD at a manageable level. |
| | 10/22/2020 | 8:11 | | 0 | 1.13 | 377.84 | 464.19 | 86.35 | | | |
| | 10/22/2020 | 9:47 | | 16 | 1.21 | 464.19 | 535.12 | 70.93 | | | |

| Total Gallons: | Total Lbs. Part A: |
|---|---|
| 10488 | 5442 |

PETRO CLEANZE Enhanced Desorption

**Terracon-Bluestone Coke**
**RegenOx Injection Summary Log**
**Part A Injections Phase 2**
**Table 3**

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| Injection Point | Date | Time | Injection Pressure (psi) | Flow Rate (gpm) | Volume of RegenOx Injected | | | Total Gallons Per Location | Batches Injected Per Location | Pounds of Part A Per Location | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Beginning Flow Meter (gal) | Ending Flow Meter (gal) | Gallons Injected Per Interval | | | | |
| HW-1A | 1/26/2021 | 11:19 | 10 | 1.58 | 0.00 | 14.44 | 14.44 | 1725 | 5.58 | 1311 | 6% concentration |
| | 1/26/2021 | 13:27 | 12 | 2.03 | 14.44 | 203.71 | 189.27 | | | | 6% concentration |
| | 1/26/2021 | 15:19 | 5 | 1.77 | 203.71 | 498.55 | 294.84 | | | | 6% concentration |
| | 1/26/2021 | 16:29 | 4 | 1.85 | 498.55 | 659.49 | 160.94 | | | | 8% concentration |
| | 1/28/2021 | 9:45 | 6 | 2.56 | 0.00 | 195.69 | 195.69 | | | | 10 % concentration |
| | 1/28/2021 | 11:26 | 6 | 2.53 | 195.69 | 497.59 | 301.90 | | | | 10 % concentration |
| | 1/28/2021 | 13:52 | 6 | 2.40 | 497.59 | 754.90 | 257.31 | | | | 10 % concentration |
| | 1/28/2021 | 15:06 | 7 | 2.74 | 754.90 | 1065.43 | 310.53 | | | | 10 % concentration |
| HW-2A | 1/26/2021 | 11:19 | 5 | 1.75 | 0.00 | 15.20 | 15.20 | 1686 | 5.46 | 1281 | 6% concentration |
| | 1/26/2021 | 13:28 | 11 | 1.66 | 15.20 | 198.08 | 182.88 | | | | 6% concentration |
| | 1/26/2021 | 15:19 | 6 | 2.04 | 198.08 | 427.93 | 229.85 | | | | 6% concentration |
| | 1/26/2021 | 16:29 | 6 | 1.96 | 427.93 | 587.41 | 159.48 | | | | 8% concentration |
| | 1/28/2021 | 9:45 | 8 | 2.72 | 0.00 | 203.06 | 203.06 | | | | 10% concentration |
| | 1/28/2021 | 11:26 | 4 | 2.69 | 203.06 | 514.74 | 311.68 | | | | 10% concentration |
| | 1/28/2021 | 13:53 | 5 | 2.75 | 514.74 | 789.35 | 274.61 | | | | 10% concentration |
| | 1/28/2021 | 15:05 | 8 | 2.68 | 789.35 | 1098.49 | 309.14 | | | | 10% concentration |
| HW-1B | 1/27/2021 | 10:08 | 10 | 2.20 | 0.00 | 226.48 | 226.48 | 1402 | 4.54 | 1066 | 8% concentration |
| | 1/27/2021 | 12:04 | 12 | 2.25 | 226.48 | 569.21 | 342.73 | | | | 8% concentration |
| | 1/27/2021 | 14:00 | 17 | 1.99 | 569.21 | 779.36 | 210.15 | | | | 8% concentration |
| | 1/27/2021 | 15:25 | 15 | 2.33 | 779.36 | 1007.30 | 227.94 | | | | 8% concentration |
| | 1/29/2021 | 10:11 | 10 | 2.54 | 0.00 | 167.43 | 167.43 | | | | 10% concentration |
| | 1/29/2021 | 12:10 | 11 | 2.58 | 167.43 | 394.67 | 227.24 | | | | 10% concentration |
| HW-2B | 1/27/2021 | 10:10 | 4 | 2.15 | 0.00 | 205.30 | 205.30 | 1369 | 4.43 | 1040 | 8% concentration |
| | 1/27/2021 | 12:04 | 5 | 2.41 | 205.30 | 524.73 | 319.43 | | | | 8% concentration |
| | 1/27/2021 | 14:00 | 5 | 2.35 | 524.73 | 730.51 | 205.78 | | | | 8% concentration |
| | 1/27/2021 | 15:25 | 6 | 2.10 | 730.51 | 958.45 | 227.94 | | | | 8% concentration |
| | 1/29/2021 | 10:11 | 8 | 2.59 | 0.00 | 176.02 | 176.02 | | | | 10% concentration |
| | 1/29/2021 | 12:10 | 8 | 2.64 | 176.02 | 410.05 | 234.03 | | | | 10% concentration |

| Total Gallons: | Total Number of Batches: | Total Lbs. Part A: |
|---|---|---|
| 6181 | 20.00 | 4698 |


REGEN Ox
PETRO CLEANZE
Enhanced Desorption

**Figure 1 – Injection Locations Map**
**Terracon – Bluestone Coke**
**4200 F L Shuttlesworth Ave N.**
**Birmingham, Alabama**

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## Photo Log

***Photo 1:*** View looking southeast. HIW-1A in view. (*Oct 15, 2020*)

***Photo 2:*** View looking northwest. HIW-2B in view. (*Oct 15, 2020*)

***Photo 3:*** View looking northwest. Trailer, injection equipment, product buckets, and hydrant in view. (*Oct 15, 2020*)

***Photo 4:*** View looking west. Significant daylighting area along railroad spur in view. (*Oct 15, 2020*)

***Photo 5:*** View looking east. Berm, surfaced material, sump pump, and waste drums in view. (*Oct 16, 2020*)

***Photo 6:*** View looking south. Berm, surfaced material, waste totes, and safety equipment in view. (*Oct 22, 2020*)

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***Photo 7:*** RRS injection trailer staged onsite. (*Jan 27,2021*)

***Photo 8:*** HIW-1B in view. (1/29/21)

***Photo 9:*** View looking across the entryway near F L Shuttlesworth Drive. Traffic delineators and hose ramps to ensure traffic could continue through area as usual.

***Photo 10:*** HIW-2B. (*Oct 15, 2020*)

***Photo 11:*** HIW-1B. (*Jan 28, 2021*)

***Photo 12:*** HIW-2B. (*Jan 28, 2021)*

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***Photo 13:*** Berm capturing surfaced material with sump pump active. (Jan 28, 2021)

***Photo 14:*** Totes used to collect surfaced material. (*Jan 28, 2021)*